PUBLIC WORKS

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CITY, COUNTY AND STATE

A New Series:
OPPORTUNITIES in Civil and Public Works Engineering
starts on page 93

Municipal Practices in IRON and MANGANESE Removal
page 88

Trickling Filter DESIGN LOADINGS
page 101

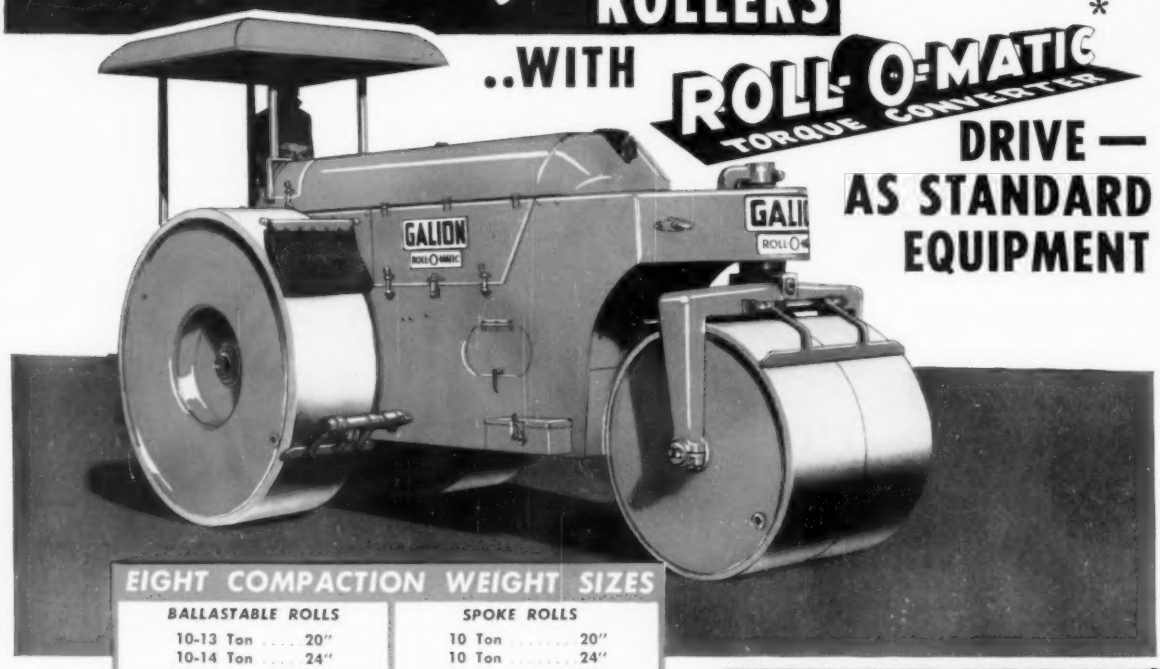
EARTH COVER and its effect on Housefly Emergence
page 109

COMPLETE CONTENTS LIST ON PAGE 5

C. Leland Wood has been City Manager of Watertown, N. Y., for the past fourteen years. His engineering training and broad experience have enabled him to render unusual service. More data on page 18.

GALION "Chief" 3 WHEEL ROLLERS

..WITH ROLL-O-MATIC* TORQUE CONVERTER DRIVE — AS STANDARD EQUIPMENT



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182 185 186 188 202 203 206 209 211 217 220 222
225 239 240 261 269 272 277 278 283 299 302 305
309 313 315 316 318 328 332 334 337 344 348 351

354 355 356 357 359 368 371 372 374 375 383
396 398 399 400 402 404 407 412 422 423 425
428 434 435 437 441 450 456 460 463 467

New Products, pages 190 to 195:

3-1 3-2 3-3 3-4 3-5 3-6 3-7 3-8 3-9 3-10 3
3-12 3-13 3-14 3-15 3-16 3-17 3-18 3-19 3-20 3
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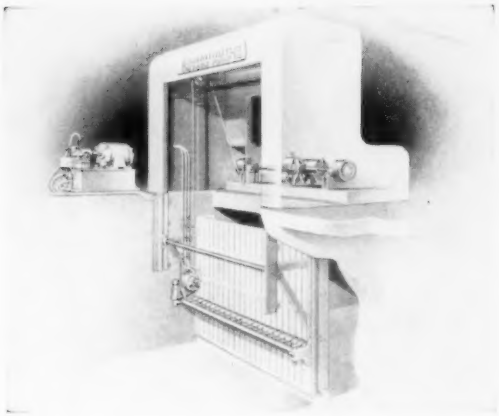
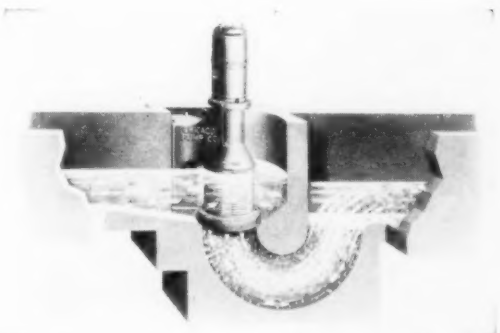


Model "A" Barminutor Screening and Comminuting Machine. Designed for use in rectangular channel sections 4 to 12 feet wide, sized for flows of 10 MGD and upwards.



The Comminutor Screening and Comminuting Machine. Designed for use in hydraulically designed feeder basin, sized for flows from .175 to 25 MGD per machine.

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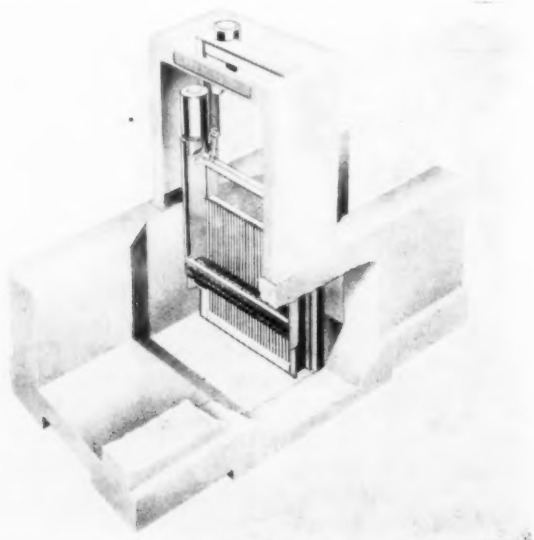

Model 7B Comminutor Screening and Comminuting Machine. Designed for use in 6" or 8" sewer pipe, sized for flows from .005 to .175 MGD per machine.

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How Yuma gets rid of its trash

The old dump for the City of Yuma, Arizona, was not only an eyesore but a breeder of vermin. Today, thanks to sound planning by City Engineer Mulford Winsor, Jr., and the dependable performance of a Caterpillar HT4 Traxcavator*, refuse disposal has become a civic asset instead of a liability.

Sanitary landfill is not new, but each city adopts it to solve its own problems. In some cases the "area" method is preferred. Yuma uses the "trench and fill" system. The HT4 digs a long trench, some 20 ft. wide and 10 ft. deep. Refuse, brought by the city's 6 trucks, is dumped into the trench, compacted by the Traxcavator, then covered with 2 ft. of clean earth. This process goes on until the trench is filled. No smoldering fires. No rats or flies. The completed section can be planted for park or playground use, or opened for building.

The CAT* HT4 Traxcavator, says Mr. Winsor, has proved a very satisfactory and economical tool for the job.

Now available in the Caterpillar line are 3 new Traxcavators, all ideal units for sanitary landfill: The No. 933 with 1-yd. capacity, the No. 955 with 1½-yd. capacity, and No. 977 with 2¼-yd. capacity. They have superior digging and lifting action and easy maneuverability. All have the new oil-type clutch that lengthens clutch life and minimizes maintenance. Another important feature is 40-degree bucket tilt-back at ground level, assuring a full load at every pass.

Yuma's HT4 Traxcavator is one of nearly 1000 Caterpillar-built machines now capably handling sanitary landfill assignments throughout the world. In the complete Caterpillar line of Traxcavators, bulldozers and scrapers, there is a size and type to match your community's needs.

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CONTENTS

MARCH, 1956 **Vol. 87, No. 3**

Traffic Control by Automation. By C. E. Wright 87
Municipal Iron and Manganese Removal. By Eskel Nordell 88
OPPORTUNITIES IN CIVIL AND PUBLIC WORKS ENGINEERING:
The County Engineer. By James F. Meisner 93
The City Engineer. By Max Sturm 95
The City Manager. By C. A. Harrell 97
The State Highway Engineer. By Rex M. Whitton 99
Trickling Filter Design Loadings. By J. A. Montgomery 101
Engineering a County Highway Department. By Wendell P. Huber 104
Speeding Installation of 60,000 Water Meters 107
Effect of Earth Cover on House Fly Emergence
By Ralph J. Black and Allan M. Barnes 109
Brackenridge Builds Its Own Power Plant 112
Designing a Sewage Treatment Plant for a Farm Colony.
By L. S. Shields, Jr. 113
Solving Difficult Pumping Problems at a Sewage Treatment Plant.
By Norman W. Anderson 115
Field Kit Simplifies Bacteriological Tests 116
Engineering Administration for a Toll Road. By A. E. Stilson 118
Time Study Stretches Your Expenditure Dollar. By Graham W. Watt 121
Where Force Account Works Best on County Road Jobs. By Pat Thomson 123
Highway Engineering in Australia 128
Street Restoration Procedures. By L. F. Flotron 130
Spring Maintenance that Lasts All Summer 132
Maintenance on Expressways. By C. M. Noble 134
Water Company Compelled to Move Water Lines in Roadway 141
Improving Activated Sludge Treatment at Davyhulme 142
Saline Water Conversion Progress in 1955 146
Treating Wool Processing Wastes 168
15 Ways to Get Better Construction and Lower Costs 170
Detergent Research Related to Water and Sewage Treatment
By F. J. Coughlin 180

PUBLIC WORKS DIGESTS

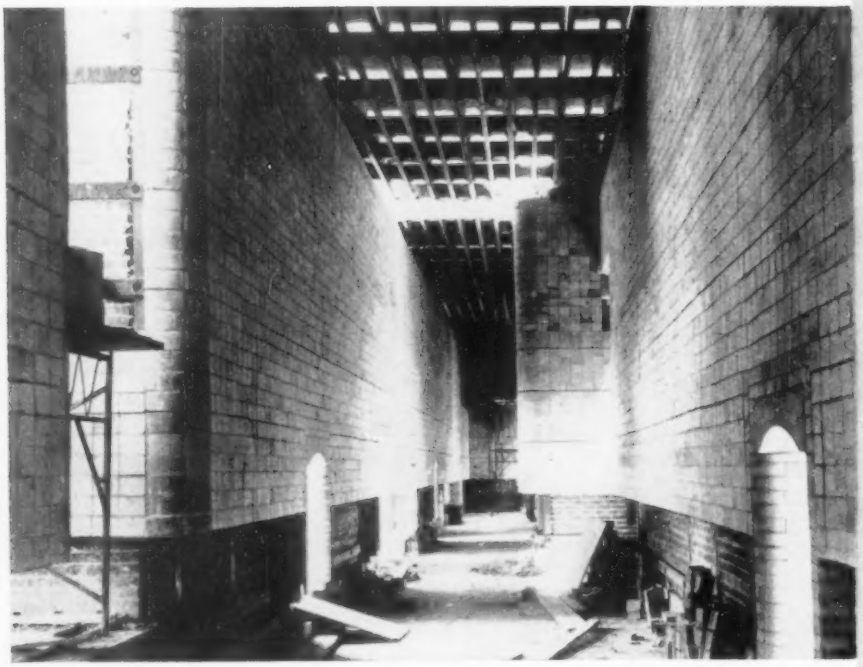
The Water Works Digest 138
The Highway and Airport Digest 150
The Sewerage and Refuse Digest 162
The Industrial Waste Digest 174

DEPARTMENTS AND SECTIONS

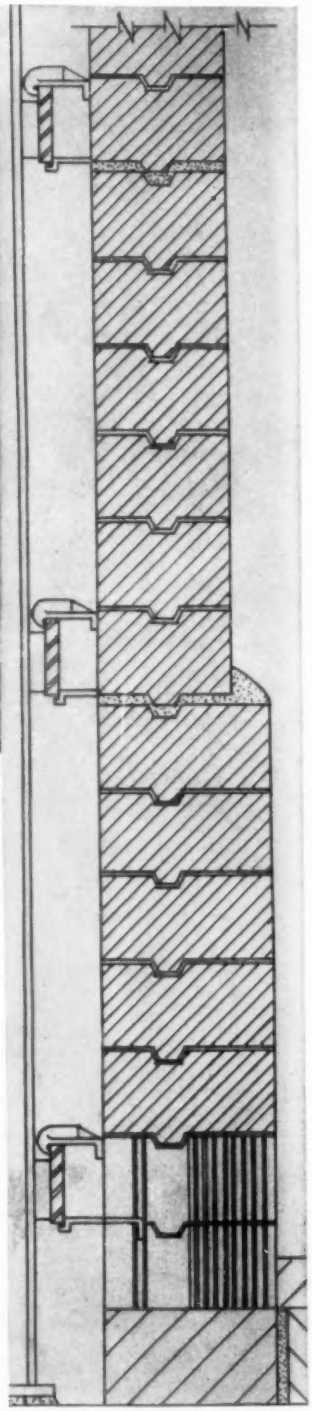
The Editor's Page 7
Washington News 14
Leader in Public Works 18
Worth Seeing 22
Letters to The Editor 30
The Engineers' Library 42
Public Works Legal Notes
By Melvin Nord 68
Up Front for Adequate Roads
By Leo J. Ritter 75
Public Works Engineering
Notes 80
APWA News 125
New Public Works Equipment 190
Worth Telling. By A. K. Akers 198

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

New trends in the use of refractories



Municipal incinerator H-type wall under construction



H-Type wall illustration shows tile spacing, support, and flexibility of wall thickness.

LACLEDE-CHRISTY H-Type Construction for Incinerators offers 5 advantages

This new H-construction, developed especially for incinerator use, offers these time and money-saving advantages:

1. **Flexibility of design**—refractories are free to move on suspensions, and castings free to move on the frame—with no sacrifice of proper calculated support.

2. **Lower costs through standardization**—minimum refractory sizes and shapes required, all standardized, low-cost tile.

3. **Ease, speed of assembly**—standardized tile and supporting members are easy to erect. Special engineering usually is unnecessary.

4. **Long service**—Laclede-Christy tile—as selected for the job—offers high quality and long life. Tile can be furnished in Missouri First Quality, Super Duty, 60% Alumina, 70% Alumina, or Colorado Semi-Silica Quality.

5. **Minimum maintenance**—combination of H-type construction and Laclede-Christy tile reduces maintenance.

Be sure to check this new H-type construction for your incinerator. Talk to your Laclede-Christy representative. If you're not quite ready, save this message as a reminder.

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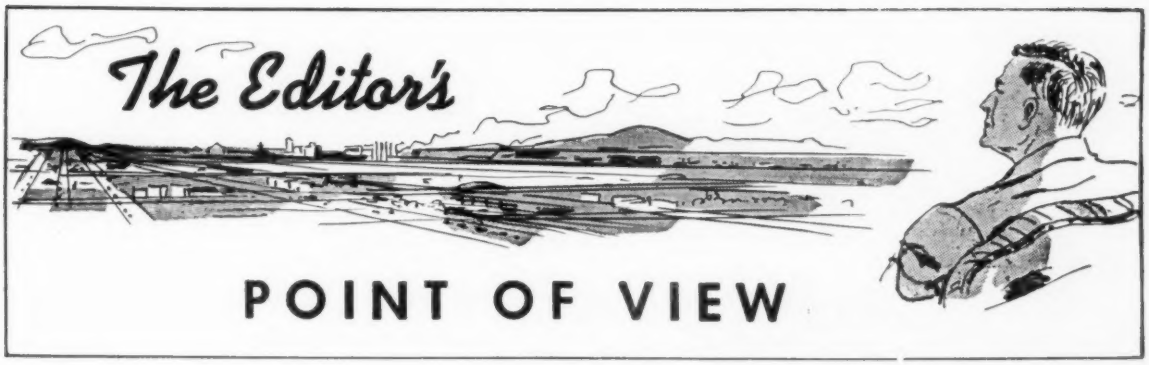


Better, Quicker and More Effective Ice Control Is Needed

THE LARGE low-pressure tires on modern automobiles quickly pack snow, especially wet falls of an inch or two, into a sheet of ice. This situation may not exist in really cold northern sections, but it provides a problem not yet solved in many eastern districts. Coupled with the very heavy automobile traffic along the Atlantic Coast, the result is traffic congestion and delay and numerous accidents. If one car gets crosswise of the lanes on one side of a 4-lane road, a traffic jam builds up quickly for miles.

Chemical salts have been a great help in ice control but there seems to be a hitch in this particular situation. Either it takes too long to get on the job, or someone is trying to accomplish false economy by waiting too long before applying the salt. We know salt and its application costs money, but so do traffic delays and congestion, a hundred or so damaged cars and a few hospital cases.

No, your editor has not been caught in one of these jams but he has seen them and has talked to people who have been tied up for several hours in them. Lacking a certain faith in the likelihood of prompt application of salt, he stays home when it looks like trouble.

Some Areas Where Research is Needed in Sanitation

IT IS POSSIBLE to take raw sewage sludge from a primary settling tank and dewater it quickly and economically. Data are not available, however, to show the health hazard that may exist from various disease causing organisms which may survive the treatment process. A study program is needed to determine these hazards and to develop a program of safeguards, if needed—and they probably will be. It is possible the hazards may vary regionally, though hookworm, for instance, is hardly likely to be the threat it was in the south thirty or forty years ago.

The changing character of refuse has been noted over the past ten or fifteen years by many observers. A study covering this general subject is now under way by a distinguished group of engineers under sponsorship of the APWA. It is hoped that this study will be able to chart the trends of change, so that we may have guide lines for the future in designing refuse disposal facilities. Consideration should also be given to the effect of such changes on collection equipment design. The costs of collecting refuse are such that no possible means of reducing them, while maintaining a high degree of municipal cleanliness, should be overlooked.

Salaries for Engineers

IN too many cases, the salaries paid engineers are not much to write about. Of course, not many engineers are actually starving; but the profession is. It needs more young men and there is little financial incentive for them to enter the profession. This fact needs correction.

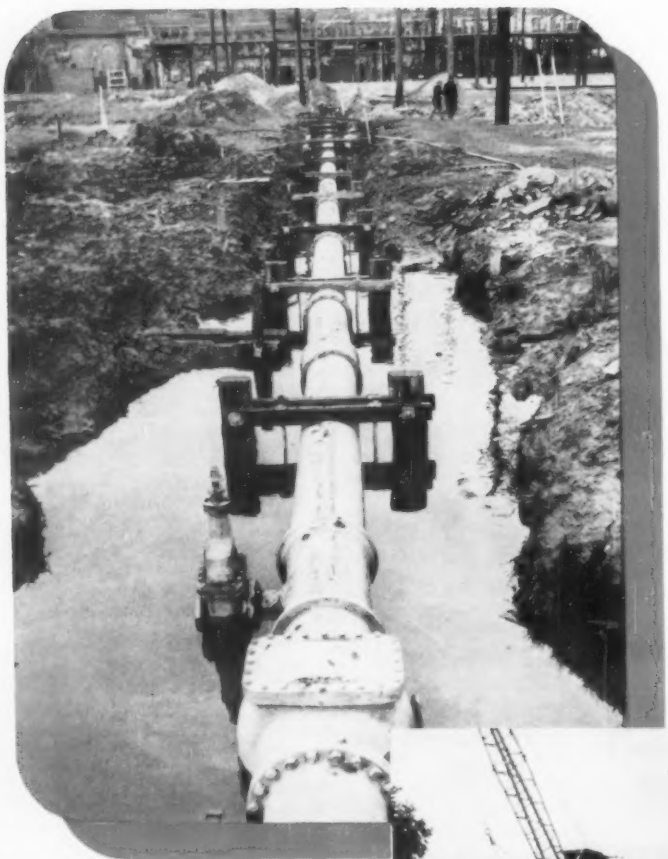
Meeting the shortage by using engineers only in positions that require engineering training is an unsound expediency. As in any profession or business, we must recognize that not all young men with technical training will develop into top-notch engineers. Actually the percentage is rather small, so we need a considerable annual increment of young men as a source from which to develop the high grade engineers essential to industry and to government.

We are all in favor of the "incentive pay" for engineers in government proposed in a recent bill before Congress. It would be a fine investment for the nation and simple justice to engineers.

One Way of Accomplishing Water Recharge

IF ONE-THIRD of the 1.2 million homes that are likely to be built in 1956 are equipped with septic tanks and subsurface disposal fields, the recharge to ground water at 300 gallons per day per family will be 120 mgd. If we assume only 5 million homes with septic tanks, the daily recharge will be around 1.5 billion gallons daily. This is a substantial amount, even though it is not even nearly sufficient to meet our growing needs for water. Probably, also, these homes are not so located as to provide recharge in the areas most vitally in need of water: but this source may represent our largest single waste water reclamation project.

You can bank on it for jobs



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About 14 miles of 16" Mechanical Joint pipe installed for supply line for water district in South Carolina.

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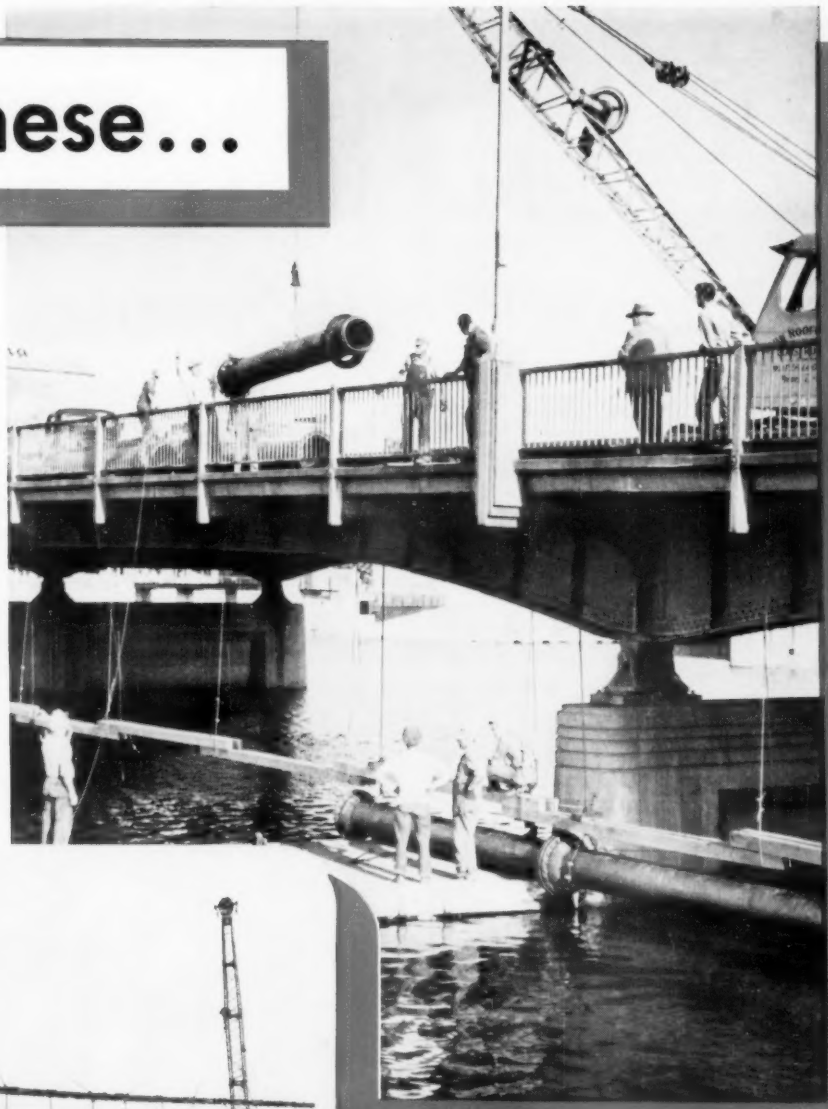

Flexible Joint cast iron pipe being laid across 600 feet-wide river at Waterloo, Iowa, for feeder line operating under 85 psi water pressure.

Installing 24-inch Flexible Joint cast iron pipe for river crossing at Fort Lauderdale, Florida.

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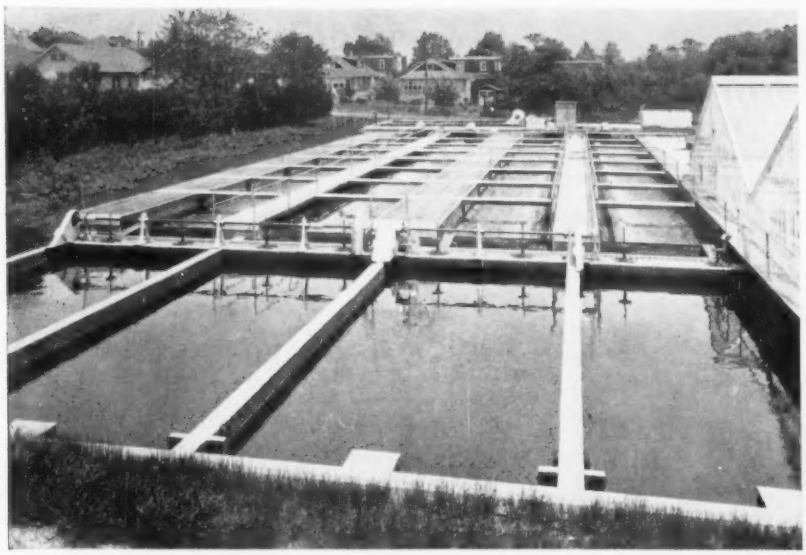

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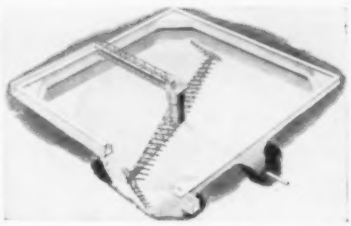
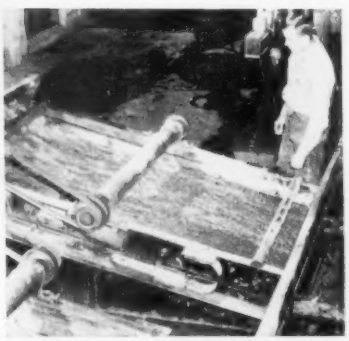


CIRCULINE COLLECTORS for square or round tanks for quick, positive sludge and scum removal in shortest time without septicity.



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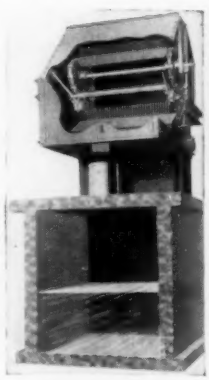
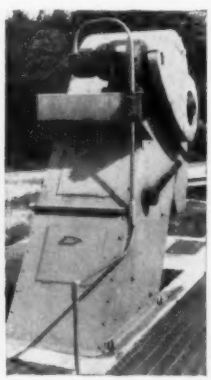
LONG life decides the eventual economy of sanitary waste treatment equipment. And after years of operation, Link-Belt systems in cities both large and small continue to provide highly effective water purification and sewage treatment service . . . with negligible maintenance expense.

Link-Belt equipment has also been welcomed in industrial plants of all kinds — particularly in states having strict anti-pollution legislation. For Link-Belt equipment can dispose of wastes at lowest cost — recover by-products for highest profit.

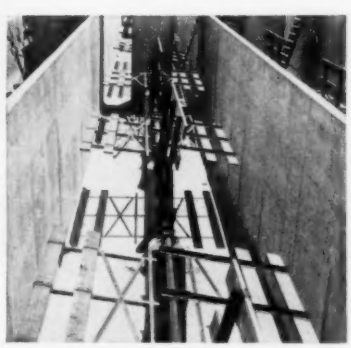
Link-Belt offers you a broad line of top-quality equipment . . . plus engineering proficiency acquired in over 34 years' experience. Our specialists will be glad to work with your own engineers, chemists and consultants to bring you the finest in modern treatment methods. Call your nearest Link-Belt office for full information and catalogs on the Link-Belt products shown here.



THRU-CLEAN BAR SCREENS — Remove large floating particles from large volumes of water — thus protect other equipment.



TRITOR SCREENS — For small sewage treatment plants—remove both grit and screenings with one mechanism.



CHEMICAL MIXERS — Link-Belt builds Straightline (shown) and flash mixers. Efficiency is assured by operation at variable speed for maximum floc formation.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,777

Thousands use our Readers' Service card to keep up to date . . . do you?

NOW *bid beating... dirt heaping...* 1956

10% bigger payloads!

Model "75" . . . boosted to 20 yds heaped (without sideboards) . . . 262 hp.

Model "55" . . . boosted to 14 yds heaped (without sideboards) . . . 172 hp.

Wide-base tubeless tires and windshield, shown, available as optional equipment.

1 Wider "Target" Push-Block makes it easier to make and maintain contact. Helps to cut loading and cycle time.

2 Straight-Line Ejector Reeving requires minimum power; leaves more power on Payscraper wheels for faster dumping and spreading. Also speeds re-threading time.

3 Sturdy Cover Plates protect new, stronger cylindrical ram and air tanks.

4 New, Straight-Back Bowl lets you heap and haul more dirt every trip. Struck capacity, *with sideboards*. 18 cubic yds on "75"—12 cubic yds on "55".

5 Higher Apron Lift, bigger apron opening, provides cleaner, more rapid dumping, especially of "sticky" materials.

6 Fast-Acting Apron, arms mounted outside bowl, assure quick, positive closing of apron. Payscraper holds the load from cut to fill.

7 Lowered Draft Frame provides operator with "control tower" visibility of bowl and push-tractor . . . also helps direct push and pull power more efficiently to cutting edge for faster loading.

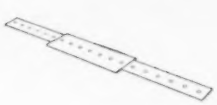
8 Larger, Wider Fenders give greater safety for operator, greater protection for machine.

International Payscrapers®

Put the 1956 International Payscraper to work on your job, and watch dirt boil up into its new, straight-back bowl. You've never seen any big scraper load as easily or as fast. In seconds, you've packed in up to 23 heaped yards. Its offset 3-section blade breaks the ground like a sharp-pointed spade. Dirt boils from the smooth-slicing cutting edge and fills the corners to build a full heaped load. Close the apron instantly, positively, on this huge, well-compacted load and you carry all the dirt you've heaped in.

Now, drive easily, effortlessly with safe hydraulic power steering at a fast clip to the fill. Note how the 1956 Payscraper's extremely high ratio of horsepower to capacity and its rapid acceleration to 24 mph top speed add up to more trips per hour than any other self-powered scraper you've ever used. Yes sir, it's a real profitable dirtmover, this 1956 Payscraper! Try one yourself on your job! See your International Industrial Power Distributor for a demonstration.

Maximum 52° Oscillation
from right to left takes the stress and strain out of hauls over furrows, rough ground.



Adjustable 3-Piece Cutting Edge
for clean, fast cutting and loading under all soil conditions.

New, Long-Lasting Clutch
of ceramic material and powdered metals, successfully resists heat and wear over longer periods. Available on Model 75 only.

INTERNATIONAL HARVESTER

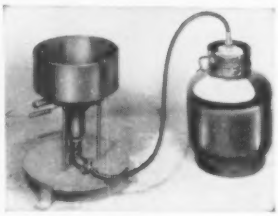
International Industrial Power

INTERNATIONAL HARVESTER COMPANY, 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-Tired Loaders . . . Diesel and Carbureted Engines . . . Farm Machinery . . . Motor Trucks.

Insto-Gas
T M REG U S PAT OFF

JUMBO FURNACE



FOR UTILITY CONSTRUCTION WORK

Now Insto-Gas offers JUMBO, an instant lighting furnace that will melt large quantities of lead, babbit, zinc and compounds quickly. Only 15 minutes heating time required for 200 pounds of lead.

The broad base of the JUMBO furnace permits use on uneven or soft ground, and a convenient bail handle makes it easy to move on the job. Cast iron melting pots with pouring lips, tilting lugs and tilting hooks are available in 100 and 200 pound capacity.

When a 50 ft. connecting hose is used the JUMBO furnace can give service over a wide area without moving the cylinder. The flame control valve is located on the furnace.

INSTO-GAS TORCHES

Utility Maintenance departments use Insto-Gas torches for soldering, sweating copper pipe fittings, preheating and thawing.

INSTO-GAS EQUIPMENT IS LISTED BY BOTH UNDERWRITERS LABORATORIES AND FACTORY MUTUALS LABORATORIES

Write today for information on SPECIAL COMPOUND MELTING FURNACE #1230, AND INSTO-HOT SALAMANDERS

MAIL TODAY

Please send information on Insto-Gas to:

Name .....

Address .....

PW .....

Insto-Gas Corporation • Detroit 7, Mich.

Washington news

Presented in cooperation with the American Public Works Association and through the courtesy of the Washington Office of the American Municipal Association

Water Pollution Control

Mark D. Hollis, Chief Engineer, U. S. Public Health Service, discussed pending legislation to extend and improve the Water Pollution Control Act at a National Conference on Public Works which was held recently in Washington, D. C. The present Water Pollution Control Act expires on June 30, 1956. Proposed legislation to extend and improve the Act was introduced in the first session of the 84th Congress, was amended and passed by the Senate, and is now under consideration by the House of Representatives.

The proposed bill, S. 890, as passed by the Senate, continues and reinforces the philosophy of recognizing, preserving, and protecting the primary responsibilities and rights of the States in controlling water pollution. The amendments proposed are aimed at strengthening Federal support of State programs through a 5-year program of matching financial grants to states and intensified research and technical assistance.

CAA "Jet Age" Conference

American cities, many of them presently paying off bonded debts for airport facilities and pressed for money to finance streets, sewers, schools, hospitals and other municipal needs, will not have the fiscal resources to construct, rebuild, and extend municipal airport runways to accommodate the giant new commercial jet airliners of the future.

This warning was addressed to aircraft manufacturers and commercial airlines by Mayor William B. Hartsfield of Atlanta, chairman of AMA's Airport Sponsor's Committee at a special CAA "Jet Age" conference in Washington, D. C. The session was called for the purpose of taking an "advanced look" at some of the problems confronting airport owners and operators four to five years hence, when the nation's airlines install jet transports in regular domestic and overseas service. Mayor Hartsfield noted that acquiring land within reasonable distances from the city for airport building and runway extensions has become increasingly difficult because of expanding home, business and industrial developments in these once open areas. The big question of noise from the jets was only partly answered. Research on a large scale is under way.

Among the principal items under discussion were: 1. Runway length and strength: CAA will undertake a study looking to revision of present minimum standards and specifications on length, strength and spacing of runways.

2. Ramp spacing requirements: Indications are that present facilities for parking large transports will normally suffice for the new jets.

3. Passenger loading: Built-in steps will be optional. The new transports will have dual passenger exits.

4. Fueling: Provisions for larger fuel-storage facilities are indicated. The new jets are being designed, however, for high-speed fueling (90 gallons per minute).

5. Effect of jet blasts on runways and runway markings: No conclusive evidence is at hand though further studies will be made of experience on military ports.

Civil Defense Plans

Development of plans for reducing vulnerability of the nation's metropolitan areas will be the responsibility of the Federal Civil Defense Administration under a new order recently issued by the Director of Defense Mobilization. At the same time, the Defense Mobilizer issued a broad policy statement calling for dispersal of new facilities important to national security. FCDA will be responsible for developing and coordinating plans to reduce urban vulnerability, includ-

Comminutor installation serves 7 years with only routine maintenance

In Madison-Chatham Sewage Treatment Plant, money saved by low installation and maintenance costs helps pay for Worthington comminutor and other public works.

"Since 1948, when our Worthington comminutor was installed, it has operated successfully with only routine maintenance. The comminutor's reliability has proved a real blessing for our plant operation."

So says Ed Molitor, Plant Superintendent, about the 25-inch comminutor in service at Madison-Chatham, N. J., Joint-Meeting Sewage Treatment Plant.

Mr. Molitor isn't alone in his opinion of the rugged Worthington comminutor. We've had similar reports wherever they're used—and that covers the country.

Learn about all the advantages of the Worthington comminutor. Contact your nearest Worthington District Office or write today for Comminutor Engineering Manual, W-317-B17, Worthington Corporation, A&SP-Public Works, Harrison, N. J.

WORTHINGTON

ALL MAJOR PUBLIC WORKS EQUIPMENT UNDER ONE RESPONSIBILITY

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CONSTANT POWER in the palm of your hand!

The Most Advanced and Complete Line in the Small Shovel Field

PRECISION BUILT, RUGGED, FULLY CONVERTIBLE... The new "*QUICK-WAY*" models, designed to heavy-duty specifications ... with more big shovel features than any other in the small shovel field ... have perfect BUILT-IN balance that guarantees precision control, greater lifting power, longer life and more work per horsepower. Write today for complete information, or see your "*QUICK-WAY*" distributor for a FREE demonstration.

"QUICK-WAY"—50	"QUICK-WAY"—80	"QUICK-WAY"—100	"QUICK-WAY"—125
¼ Yd. 5 Ton	⅜ Yd. 8 Ton	½ Yd. 10 Ton	½ Yd. 12½ Ton

AND FIVE NEW "QUICK-WAY" CARRIERS

"QUICK-WAY" TRUCK SHOVEL CO. DENVER, COLO. A Penn-Texas Subsidiary

with MORE Big Shovel Features

ANTI-FRICTION BEARINGS—Self-aligning anti-friction bearings on all high-speed continuous rotating shafts and drums. Special bronze bearings on swing rollers and center rotating sleeve.

BULL GEAR, HOOK ROLLERS and MACHINERY FRAME—Heavy, fully machined, hardened steel rollers and roller path. Large sturdy cast steel and electrically welded machinery frame.

ALL CHAIN and SPROCKET DRIVE—Machine-cut steel and cast iron sprockets with compact, high speed, heavy duty roller chains. Oil and dust tight cases.

POWER UP AND DOWN BOOM STANDARD ON ALL MODELS

MAIN ASSEMBLIES—High tensile steel shafting. Any one main assembly removable without tearing down others. Positive control shaft centers for 100% clutch and brake action.

AIR COOLED DRUMS—Large size, louver ventilated, ductile iron clutch and brake drums, finned-ventilated swing assembly drums designed for cool continuous running.

CLUTCH CONTROLS and HYDRAULIC SYSTEM—Smooth, positive minimum effort control from new hydraulic system. New design control lever locks.

ADVANCE DESIGN LUBRICATION—Daily grease fittings centrally located in cab panel. Intermittent grease fittings easily accessible. Positive grease and dirt seals at all revolving points. Forced-feed, filtered circulating lubrication on all chain and sprocket drives and on main shaft bearings. Main bearings also running in oil.

COMFORTABLE FULL VISION CAB—All operating controls, including instrument panel and lock throttle, conveniently located in front of operator. Safety glass windows on all sides and top insure full vision. Sliding and hinged windows provide maximum ventilation.

HINGED PANELS FOR EASY MAINTENANCE—Hinged fold out panels all around for quick, easy maintenance and adjustment.

With the Famous Money-Making Line of "QUICK-WAY" ATTACHMENTS

Mail Coupon Today!

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Dept. 356—2401 East 40th Ave.
Denver 5, Colorado, U.S.A.

Send complete information on the new "Quick-Way" Models and Carriers. Check model numbers interested in 50( ), 80( ), 100( ), 125( ).

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ing coordination at the metropolitan target zone level, of dispersion, urban redevelopment, highways and allied programs. The FCDA will also advise and assist state and local governments, particularly those located in urban areas, on measures to continue essential functions in the event of enemy attack.

Flood Insurance

The Administration asked Congress to authorize a $3 billion, five-year "frankly experimental" program of Federal-state flood insurance and reinsurance. Sen. Bush, who introduced the bill, said the plan is designed to "provide a sound, workable program of flood indemnity and reinsurance which the people will be able to purchase at reasonable cost." Rep. Wolcott, of the House Banking Committee, introduced an identical bill in the House. Sen. Bush noted a staff study by the Senate Banking Committee had found floods are the only kind of natural disaster "against which private insurers do not provide protection." The bill, however, does not spell out exactly how an individual would go about applying for the insurance to be provided by the Government.

Other officials, however, said individuals would buy the new insurance from private insurance firms, which would act as agents for the Government. These firms approved by the Government, would do all selling and servicing of disaster insurance contracts, officials explained. For their services, they added, the Government would pay the private companies brokerage fees.

• • •

Traffic Engineering Fellowships at Yale Announced

The Yale University Bureau of Highway Traffic announces the availability of fellowships in its Traffic Engineering course for the academic year starting September 17, 1956. The course of graduate study is devoted to the planning and operational design of new streets and highways and to the regulation and control of traffic movements. The fellowships are to be awarded on a competitive basis to applicants who are residents of the continental United States and are graduates of an accredited school in engineering. The closing date of filing is April 1st. Write the Director, Bureau of Highway Traffic, Yale University, Strathcona Hall, New Haven, 11, Connecticut.

AERIAL MAPPING

cuts survey costs up to 75%— gets construction started WEEKS earlier!

The speed and accuracy of Alster large-scale mapping from aerial photography often produces even greater savings. Alster recently completed aerial mapping of the 17,500 acre U.S. Air Force Academy site *five times faster* and at *less than one-fourth the cost* of comparable ground surveys.

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Double Jacketed Rubber and Asphalt Furnace

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Melt Pipe Joint Compound Faster—without Overheating

in

HAUCK Compound Melting Furnaces

Oil or Gas Fired

Melt and heat all kinds of sewer and water main compounds, including Mineralead, Hydro-tite, JC-60, G.K., Leadite, Haymanite, KNR, Duro-Seal, Wedgetite; protective coating enamel, asphalt, tar, pitch, in a Hauck Furnace. Pipe joint compound always at right temperature.

No flame impingement on pot—no carbon—no smoke. Available with agitator. Pot capacities—8 to 25 gals. Write for bulletins.

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ASPLUNDH CHIPPER

Tapered Blades and Wedges — For *Absolute Safety*. Insures positive locking action. Unparalleled performance, longer life.

Simplicity in Design — Change or service blades in 20 minutes. Ready accessibility permits service quickly *right on the job*. Minimum of moving parts means less maintenance, lower repair costs.

Flywheel — For constant, uniform and faster chipping action; eliminates engine slow-down; permits reduced size of power unit resulting in lower operating costs.

Asplundh Chippers have been engineered and proven by the World's largest tree company. The many ways you benefit by using them are told in a booklet, "The Modern Approach to the Brush Problem." Send coupon below for your free copy TODAY.

Ask for a no-obligation demonstration

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Please send me FREE BOOKLET, *The Modern Approach to the Brush Problem*

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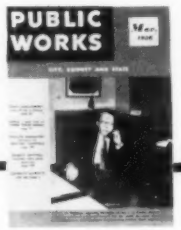

LEADER IN PUBLIC WORKS

C. Leland Wood has been City Manager of Watertown, N.Y., since 1940. This unusual tenure of office for a city manager reflects the fine service he has rendered to his city over the years. For thirty years he has been in municipal service—14 years as Engineer-Superintendent for the Municipal Commission of Herkimer, N.Y., and 16 years with Watertown. Prior to 1926 he engaged in various forms of engineering work following his graduation from Union College with a degree of BE. He says "The broad experience in these various fields of engineering prior to accepting the positions of an administrative nature with municipalities has made the work much easier. My selection of a college course of administrative civil engineering also was a wise choice and the studies in that option provided theoretical training for the work in municipal administration." He actually started his engineering work while attending high school and college, assisting his father who was Chief Engineer and Surveyor for the New York State Conservation Department.

He is a member of many technical and professional associations — AWWA, International City Managers Ass'n. and N. Y. State Municipal Electric Ass'n.; also of a number of civic clubs and organizations. He is married and he and Mrs. Wood have two daughters. His hobbies are golf and fishing. He has a great liking for and pride in the northern New York area and has about persuaded your editor—who had the pleasure of being in college with him and taking the same civil engineering option—to come up and try the golf and fishing.

BRING ON YOUR RIVERS!

CLOW RIVER-CROSSING CAST IRON PIPE TAKES 'EM "IN STRIDE"!

EASY TO LAY. As easy to make up as a standard flanged joint. Lower labor installation cost because of ease of joint make-up and longer laying lengths.

ONLY A RATCHET WRENCH NEEDED. No split parts. Fewer parts—each joint consisting of one complete pipe, one solid follower ring, one solid ring gasket, bolts and nuts.

FULL 15° TURNING DEFLECTION with absolutely no reduction in the full internal opening area—therefore, no abnormal pressure-drops at deflected joints. Deflection stresses evenly distributed among all the bolts.

LONGER LAYING LENGTHS—approximately 18'6"—faster installation, lower costs. However, lengths may be varied to suit conditions. For example: 6 foot, 12 foot or other special lengths may be advisable to suit required curvature.

Mail coupon for complete information on Clow Ball-and-Socket River-Crossing Pipe. No obligation, naturally.

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Please send me, without obligation, details and specifications of Clow Ball-and-Socket River-Crossing Pipe.

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Street Address_____
City_____ **Zone**____ **State**____
Individual's Name_____
Position_____

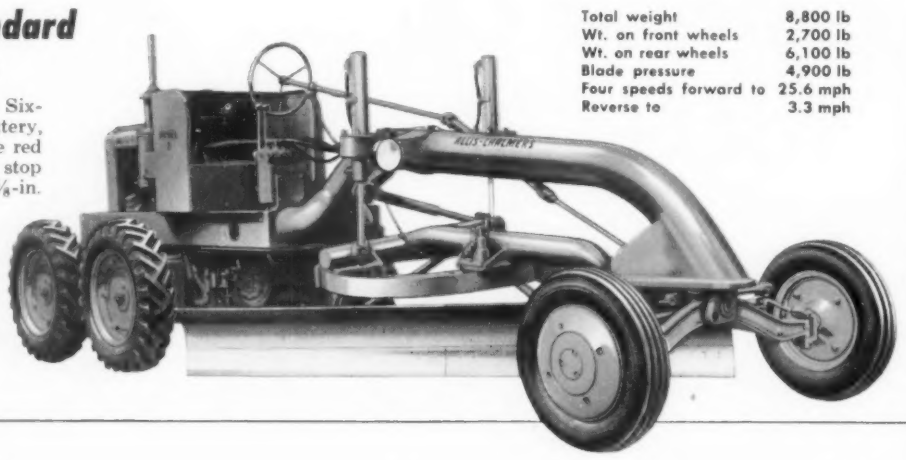
Now's the time to mail this month's Readers' Service Card.

Model D *Standard*

(GASOLINE ENGINE)

Standard Equipment: Six-volt electric generator, battery, two white headlights, one red combination rear and stop light, muffler, 10-ft by 5/8-in. moldboard, hydraulic controls for moldboard lift, four 7.50-20 (6 ply) rear and two 6.50-16 (6 ply) front pneumatic tires with regular tubes.

Total weight	8,800 lb
Wt. on front wheels	2,700 lb
Wt. on rear wheels	6,100 lb
Blade pressure	4,900 lb
Four speeds forward to	25.6 mph
Reverse to	3.3 mph

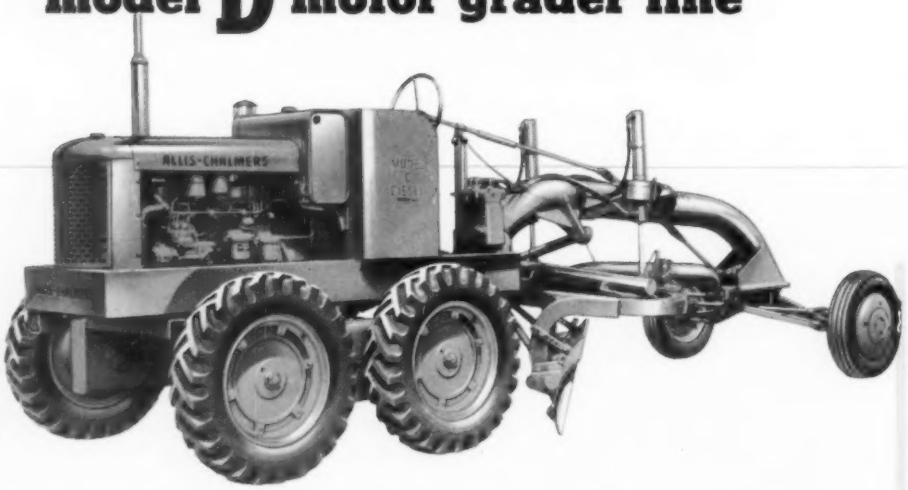


Match your grading needs with

from the Allis-Chalmers model D motor grader line

Model D Diesel *Standard*

Total weight	9,350 lb
Wt. on front wheels	2,760 lb
Wt. on rear wheels	6,590 lb
Blade pressure	4,900 lb
Four speeds forward to	25.2 mph
Reverse to	3.2 mph



Standard Equipment: Twelve-volt electric generator, battery, two white headlights, one red combination rear and stop light, muffler, 10-ft by 5/8-in. moldboard, hydraulic controls for moldboard lift, four 7.50-20 (6 ply) rear and two 6.50-16 (6 ply) front pneumatic tires with regular tubes.

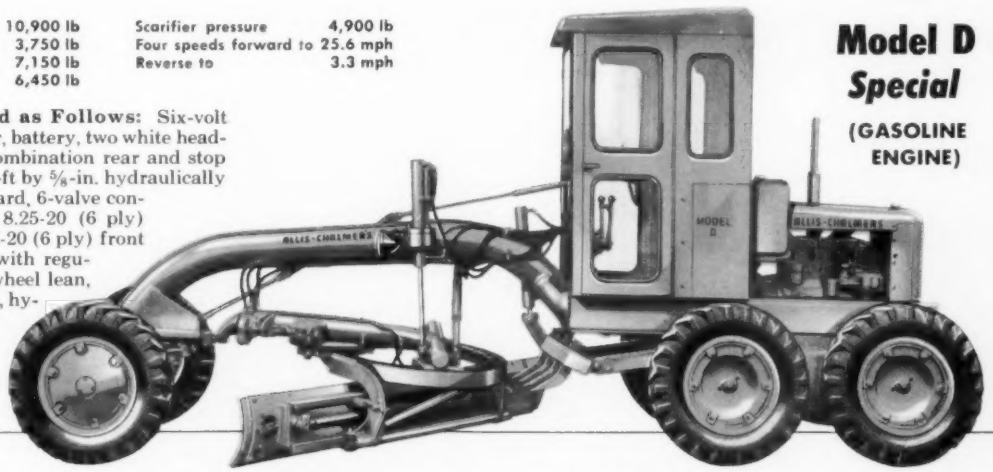
Both gasoline and diesel Model D's are available with any combination of accessories.

You can still buy a Model D for one-third the cost of a large motor grader, and it's the most popular, most versatile small grader on the market. In addition to the units illustrated, the Model D is available with other combinations of accessories . . . or with any of these useful attachments: rear-mounted 5/8-cu-yd loader; shoulder maintainer; one-pass windrow eliminator; V or blade-type snowplows. Ask your nearby Allis-Chalmers dealer for a demonstration . . . and prove the Model D's value to yourself.

Get full details of this month's products . . . mail your Readers' Service card today.

Total weight	10,900 lb	Scarifier pressure	4,900 lb
Wt. on front wheels	3,750 lb	Four speeds forward to	25.6 mph
Wt. on rear wheels	7,150 lb	Reverse to	3.3 mph
Blade pressure	6,450 lb		

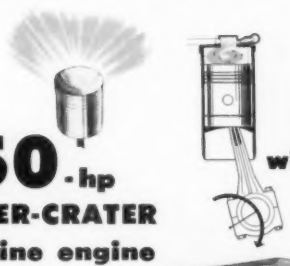
Fully Equipped as Follows: Six-volt electric generator, battery, two white headlights, one red combination rear and stop light, muffler, 10-ft by ⅝-in. hydraulically shiftable moldboard, 6-valve control group, four 8.25-20 (6 ply) rear and two 8.25-20 (6 ply) front pneumatic tires with regular tubes, front wheel lean, power circle turn, hydraulic scarifier, all-steel cab.



Model D Special
(GASOLINE ENGINE)

new economy and efficiency

NOW AVAILABLE WITH YOUR CHOICE OF TWO OUTSTANDING ALLIS-CHALMERS ENGINES

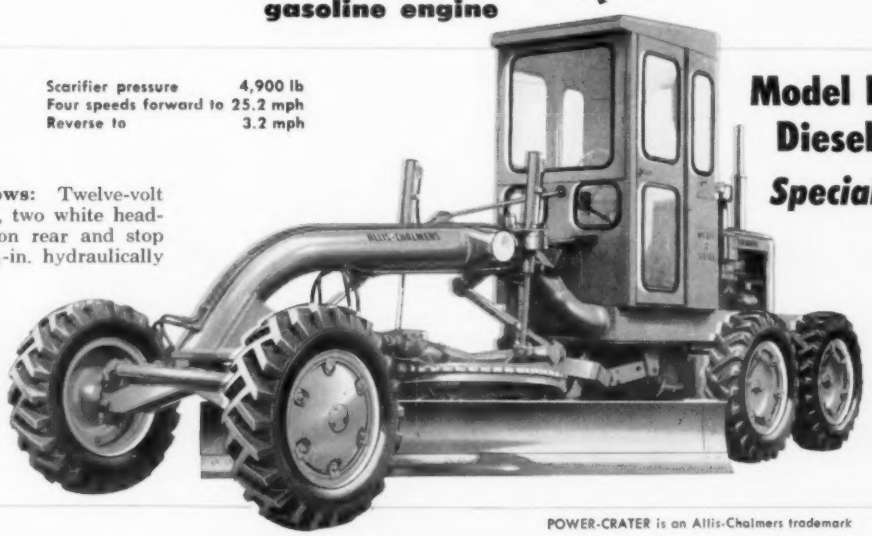


50-hp POWER-CRATER gasoline engine

50-hp diesel engine with follow-through combustion

Total weight	11,450 lb	Scarifier pressure	4,900 lb
Wt. on front wheels	3,750 lb	Four speeds forward to	25.2 mph
Wt. on rear wheels	7,700 lb	Reverse to	3.2 mph
Blade pressure	6,450 lb		

Fully Equipped as Follows: Twelve-volt electric generator, battery, two white headlights, one red combination rear and stop light, muffler, 10-ft by ⅝-in. hydraulically shiftable moldboard, 6-valve control group, four 8.25-20 (6 ply) rear and two 8.25-20 (6 ply) front pneumatic tires with regular tubes, front wheel lean, power circle turn, hydraulic scarifier, all-steel cab.



Model D Diesel Special

POWER-CRATER is an Allis-Chalmers trademark

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

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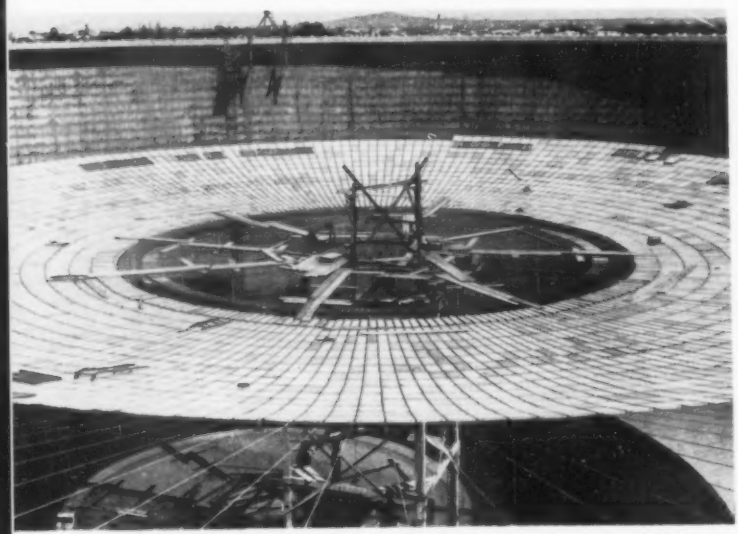
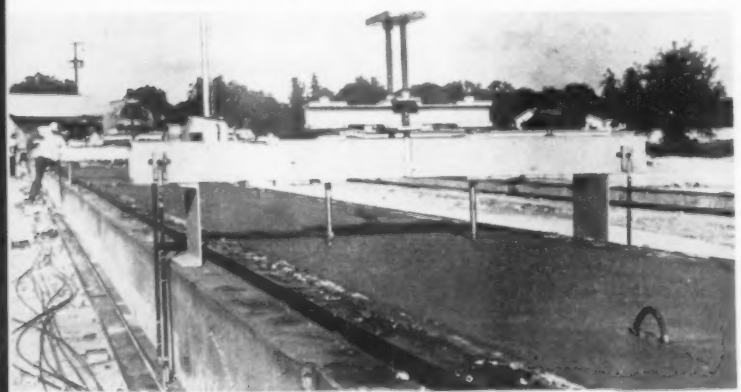
—Worth Seeing



Spiderweb roof resulted when Montevideo, Uruguay, wanted the central building of an industrial exposition to be convertible afterward into a stadium seating 24,000. Local licensee of the Preload Co., New York City, came up with the unusual construction pictured above.

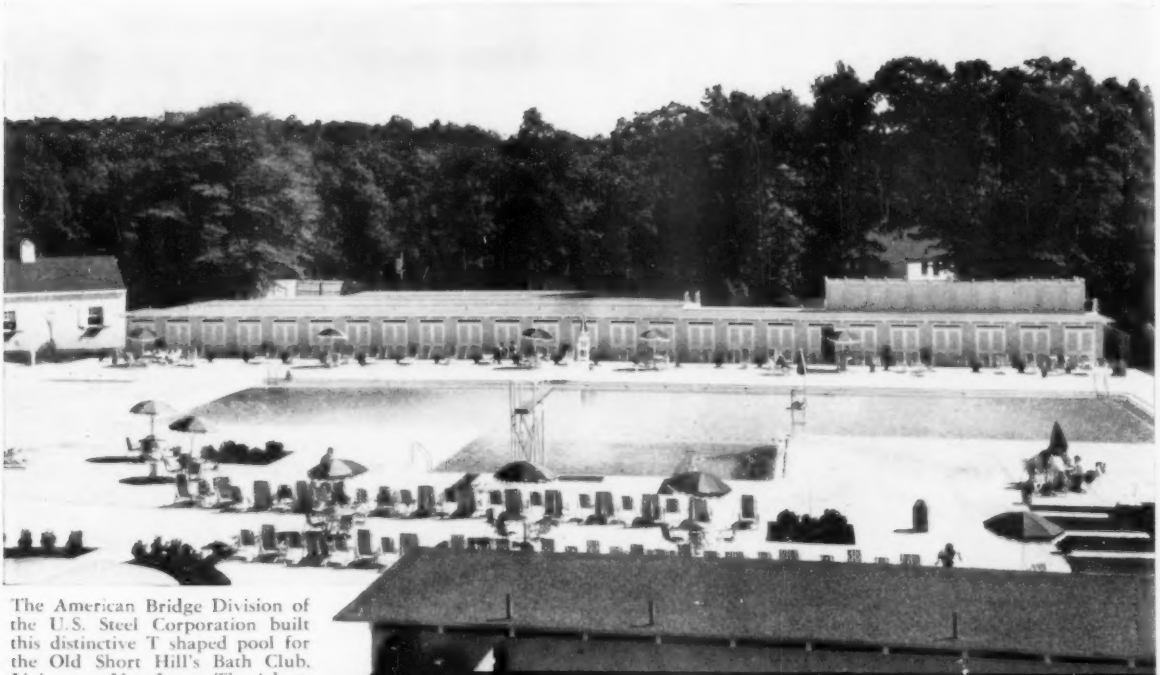


"**Form-Crete**" camber control devices in action. In other words, these stabilizers of the Florida Division, Food Machinery and Chemical Corp., enable a concrete products manufacturer to maintain the desired catenary effect in finished prestressed beams under design load.

Latest assault on the low form of life known as the "litterbug" is illustrated by New York City's 20-ft. high litter basket displayed in Times Square by the Department of Sanitation of the City of New York.

Twin 300-ft. sections of Baltimore's new $50 million harbor tunnel. Special turning rolls devised by Worthington Corp. rotated the shells to expedite prefabrication welding of the steel shell sections.

Awards for best preventive maintenance on Roto-Pac units in 1955 were made to Philadelphia refuse collection drivers. Here savings bonds donated by City Tank Corp. and Eastern Body Co. are handed to Philadelphia officials for distribution to men.



The American Bridge Division of the U.S. Steel Corporation built this distinctive T shaped pool for the Old Short Hill's Bath Club, Livingston, New Jersey. The Adams Double SPF-238 Poro-Stone Filter shown below, recirculates the 348,000 gallons of pool water every six hours — a rate of approximately 2 gallons per minute per square foot of filter area.

Another Modern Pool with ADAMS *SPF* FILTERS

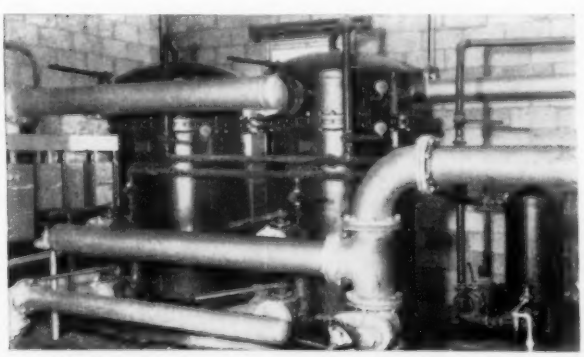
Yes, here's another distinctive pool with the popular Adams Poro-Stone filters. And, there are some good reasons why more and more public pools are insisting on Adams.

First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements.

The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4¼" O. D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to *specify* and *buy* Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the handy coupon below.



R. P. ADAMS COMPANY, INC. M-56
228 EAST PARK DRIVE, BUFFALO 17, N. Y.

Please send me by return mail your new Bulletin 625.

Name ..... Title .....

Business .....

Street .....

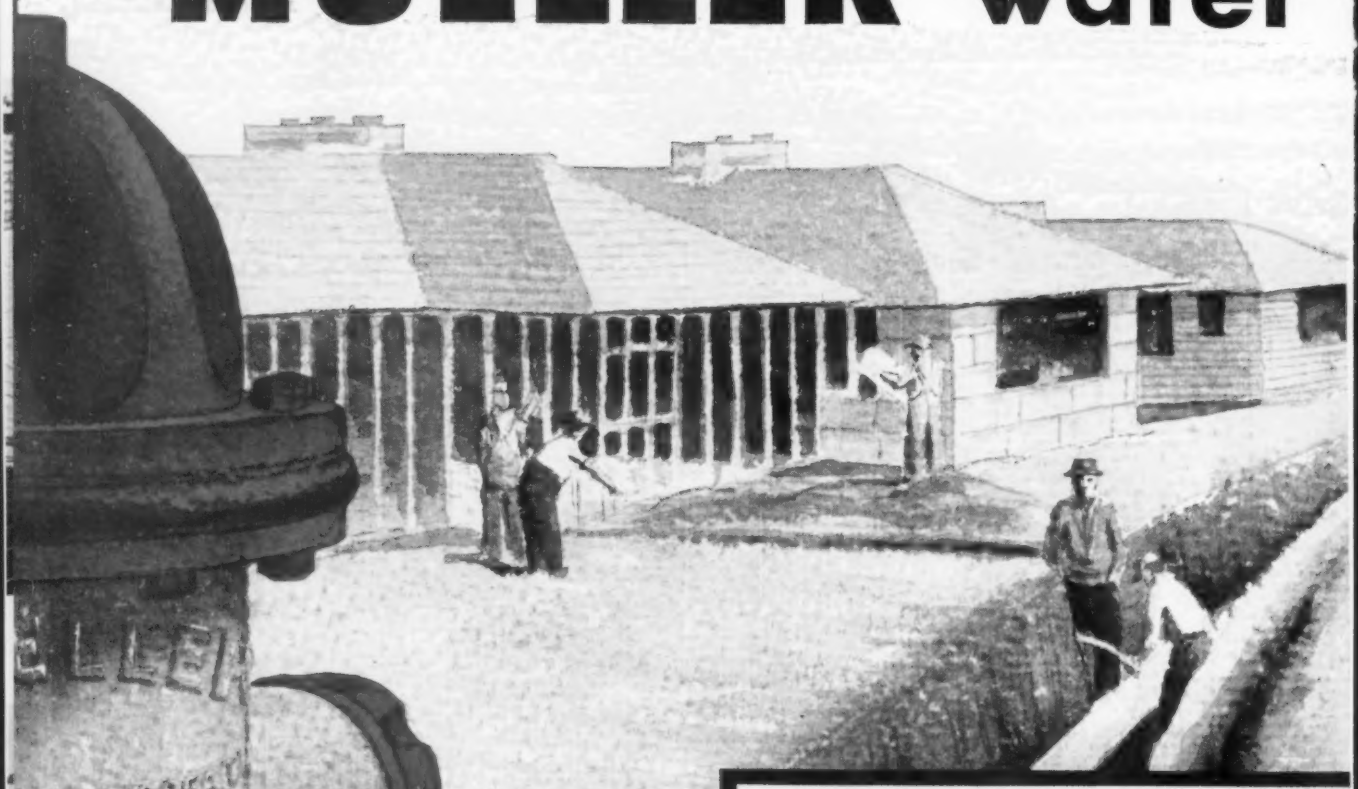
City ..... State .....

Size of pool is ..... gallons.

R. P. ADAMS CO., INC., 228 East Park Drive, Buffalo 17, N. Y.

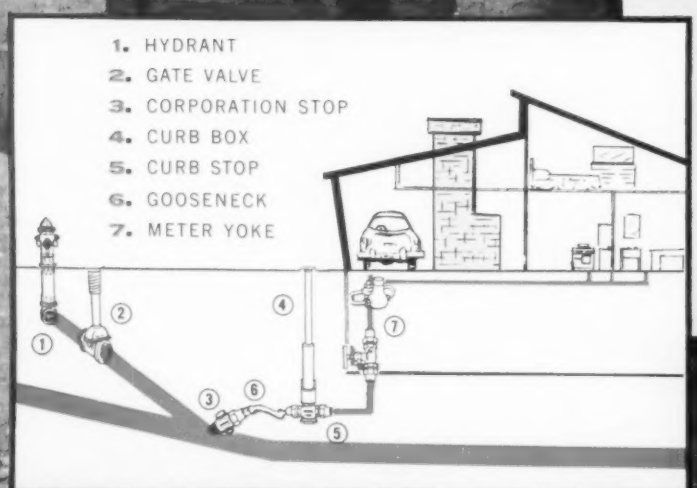
Get full details of this month's products . . . mail your Readers' Service card today.

MUELLER® water



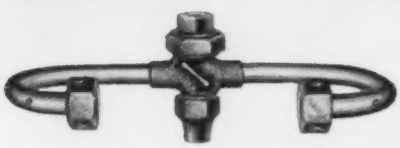
Hydrant •
Compression type valve with removable seat. Has force flushed drain valves. Safety stem coupling and flange break upon impact—the unbreakable barrel is quickly replaced without shutting off water. Automatic lubrication of the stem threads. Shoes to fit any main.

Curb Box •
Telescopic type. Minneapolis Pattern or arch pattern base with footpiece. Iron to bronze threads assure easy removal of lid or plug. Lengths from 2′ through 10′. Accommodates stops ½″ through 2″.

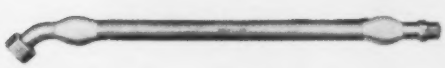


distribution products

From the main to the meter. Dependable water distribution systems are a result of careful planning for expansion and installation of products that are designed and manufactured to give years of trouble-free service without maintenance. Mueller water works equipment and products are engineered to give dependable service and are made of the highest quality materials to give long life. A complete range of sizes with various combinations of inlets and outlets adapts them to any water distribution system.

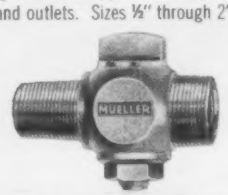


Meter Setting Equipment
Copper or iron meter yokes with multi-purpose end connections. Horizontal or vertical inlet and outlet combinations. Meter relocaters, couplings and stops.

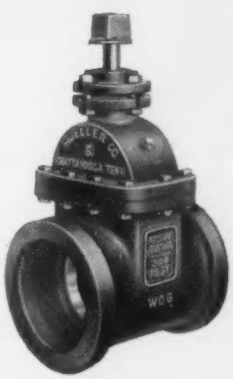


Gooseneck • Wiped joint, lead flange and solder joint types. Sizes ½" through 2". Lengths 18" through 36". Branch types also available.

Curb Stop • Inverted and upright key. Regular and Minneapolis pattern. Key is precision ground and lapped into body. All types of inlets and outlets. Sizes ½" through 2".



Corporation Stop • May be inserted into main under pressure. Precision ground key individually lapped into body, assuring positive shut-off. Variety of inlets and outlets. Sizes ½" through 2".



Gate Valve • Rising and non-rising stem. "O" ring or conventional stem packing. Exclusive "four-point" disc wedging mechanism exerts pressure on perimeter of discs. Variety of ends for any main. Sizes 2" through 48".

If you are not familiar with the complete line of Mueller water distribution products and the equipment with which they are installed, contact your Mueller Representative or write direct for Catalog W-96.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS

Transite Pressure Pipe assures dependable service through the years

ENGINEERS and city officials face much the same problem in pipe selection. It is twofold: (1) How to make sure the community gets many long years of trouble-free performance from its pressure mains, and (2) How to do this as economically as possible by choosing pipe for durability plus savings.

Transite® Pressure Pipe is solving this problem in hundreds of municipalities and water districts from coast to coast. Here's why. An asbestos-cement product, strong and durable and highly resistant to corrosion, it has effected economies in installation as well as operation.

For example, the community benefits even at the very outset, since both handling and assembly of Transite Pressure Pipe are so simple that crews can install as fast as trench is opened. This means lower installed costs.

Another Transite Pipe characteristic instantly recognized by engineers as of major importance is its smooth interior that stays smooth. This provides maintained high flow capacity. (Flow coefficient is C-140.)

* * *

For further information about Transite Pressure Pipe with the Ring-Tite® Coupling, write for Booklet TR-160A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

JM PRODUCTS

Johns-Manville TRANSITE PRESSURE PIPE
WITH THE RING-TITE® COUPLING

Thousands use our Readers' Service card to keep up to date . . . do you?

For extra fire fighting protection ...choose INTERNATIONAL Trucks

8 Specialized All-Truck Models
9 High Torque All-Truck Engines

If your community is in need of new fire trucks, you can get extra protection when you choose dependable INTERNATIONAL fire truck chassis. **Here's why:**

INTERNATIONAL Trucks give you *specialized* fire fighting units, with *locally-available* parts and service. They are *all-truck built,* with no passenger car engines or components asked to do a fire truck job. They have high horsepower, high torque standard and optional engines that deliver maximum *usable* power where you need it—for fast starts, quick acceleration after turns, full pressure pumping from 300 to 1,500 GPM. They give you extra truck life, extra dependability, save you the BIG money in operation and maintenance.

Whatever your fire protection requirements, INTERNATIONAL Trucks provide the answer in eight specialized chassis—9 engines—many other all-truck models. Ask your INTERNATIONAL Truck Dealer or Branch to give you complete details.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

INTERNATIONAL R-1856 Specialized Fire Truck Chassis, 21,000 lbs. GVW. Front axle rated capacity 5,000 lbs. (7,000 lbs. axle available to give 23,000 lbs. GVW). Rear axle rated capacity 16,000 lbs.

S- and SC-166 (conventional, cab-forward)—131-hp BD-240 or 140-hp BD-264 engine.

S-176—103.5-hp BD-269 or 137-hp BD-282 engine.

S- and SC-186 (conventional, cab-forward)—137-hp BD-282 or 150.4-hp BD-308 engine.

R-1856—165-hp RD-372 or 175-hp RD-406, 182-hp RD-450, 212-hp RD-501 engine.

R-196—165-hp RD-372 or 175-hp RD-406, 182-hp RD-450, 212-hp RD-501 engine.

R-206—175-hp RD-406 or 182-hp RD-450, 212-hp RD-501 engine.

All-Truck Built to save you the BIG money!

INTERNATIONAL® TRUCKS

HEAVY-DUTY SALES LEADERS 24 STRAIGHT YEARS!

Motor Trucks • Crawler Tractors • Industrial Power • McCormick® Farm Equipment and Farmall® Tractors

Need more facts about advertised products? Mail your Readers' Service card now.

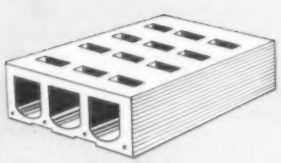
PITTSFIELD, ILLINOIS

Combines these 6 big advantages of

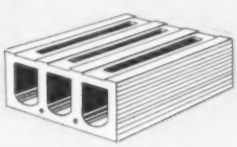
with TFFI specification vitrified

1. LOW COST. First costs are reasonable, and low-cost operation will save your community money.
2. SIMPLE, EASY OPERATION. In most plants one man in a 40 or 44-hour week can do the work.
3. LONG LIFE—longer than the life of the bonds issued to pay for them.
4. GOOD RESULTS—top notch effluent—say 20 ppm BOD, day after day, year after year.
5. RELIABILITY distinguishes their performance always.
6. OVERLOAD IS NO PROBLEM. Take temporary shock loads—or those of a new industry right in their stride.

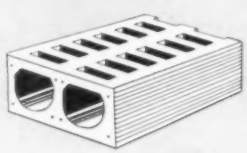
TRICKLING FILTER



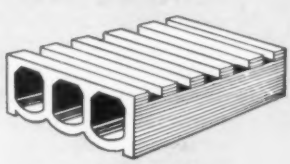
DICKEY
W. S. Dickey Clay Mfg. Co.
902 Walnut St.
Kansas City 6, Mo.



POMONA
Pomona Terra-Cotta Co.
Pomona, N. Car.



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

Modern trickling filter plant at Pittsfield, Illinois

Warren & Van Praag, Consulting Engineers, Decatur, Illinois.

Contractor, Thomas J. Sheehan, 23rd and Olive Streets, St. Louis, Mo.

Major Equipment, PFT Rotary Distributor for 85′ filter bed; right, 35′ Digester with PFT floating cover. Also, PFT Heater and Heat Exchanger are used.

Trickling Filter Plants

clay bottom blocks

☆ ☆ ☆

Get new TFFI Handbook

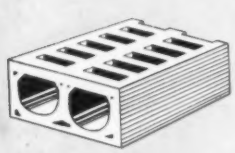
The full illustrated story of

TFFI *vitrified clay filter bottom blocks*, their advantages, efficiencies, and economies is in the new 1954 revised edition of the popular HANDBOOK OF TRICKLING FILTER DESIGN. If you lack a copy, just write any member of the Institute listed below for one. It's free.

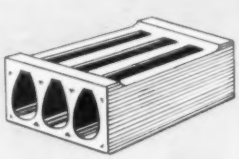
Recommended underdrain Specifications

Standard Specifications for Vitrified Clay Filter Blocks for Trickling Filters are given in full on pages 37 and 38 of the 1954 revised edition of the HANDBOOK OF TRICKLING FILTER DESIGN. These specifications cover types of blocks, compressive strength, absorption, shape, permissible variations, apertures, shell and web thickness, drainage channels, workmanship, markings, testing — everything that an engineer needs to write specifications for trickling filter blocks. Secure your copy from any TFFI member listed below.

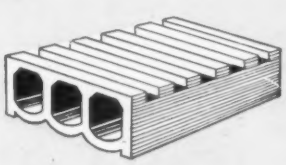
FLOOR INSTITUTE



BOSCO
Bowerston Shale Co.
Bowerston, Ohio



NATCO
Natco Corporation
327 Fifth Ave.
Pittsburgh 22, Pa.

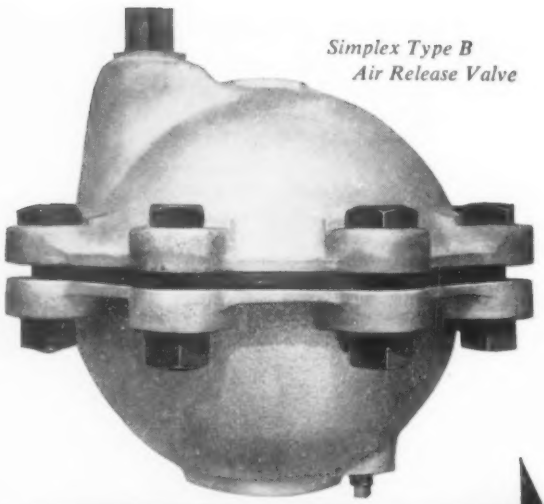


TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.

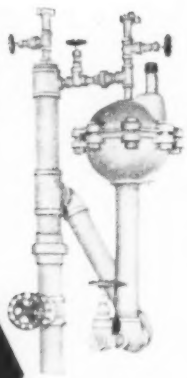
TFFI

Symbol of
good treatment

Now's the time to mail this month's Readers' Service Card.



Simplex Type B Air Release Valve



One 2" connection to your sewage main

cuts pumping costs

Here's the low-cost way to reduce the high costs of pumping sewage. The Simplex Type B Air Release Valve rids lines of entrained air and sewage gases . . . puts an end to binding at high points. It quickly pays for itself by lowering the friction head, increasing pumping capacity. **How you save!** When air and gases collect in the upper valve shell, they depress the rugged ball float . . . automatically opening the needle valve so that all entrained air and gas escape *immediately!*

CHECK THESE ADVANTAGES!

- Reliable! Bronze seat with silicon rubber-tipped valve stem designed to prevent sticking shut or leaking water.
- Rugged! Cast iron shell and non-corrodible float can take pressures up to 250 psig.
- Simple—few parts, just one lever movement.
- Vacuum-holder prevents loss of prime.
- Easy back-flushing with no permanent connection to clear water supply.
- Shipped complete with pipe leg to collect sediment and valve to blow it off.
- Easy to install—just one quick connection.

WRITE FOR BULLETIN 1204
Simplex Valve & Meter Company, Dept. PW-3
7 East Orange Street, Lancaster, Pa.

ACCURATE INSTRUMENTS AND CONTROLS SINCE 1904

SIMPLEX®
VALVE AND METER COMPANY

Get full details of this month's products . . . mail your Readers' Service card today.

SEWER INFILTRATION

Reference is made to your January issue of PUBLIC WORKS, page 52, under article captioned "Letters to the Editor". I, too, am very much interested in the execution of an exfiltration test. Any information you have on this operation, or directions for obtaining same, would be greatly appreciated.

Raymond Jennings
Director of Public Works,
Texas City, Texas.

We read with interest the letter to the Editor of Mr. George Talcott in your January issue.

We are wondering if we might also obtain a copy of your article on exfiltration testing from the August 1946 issue of "Public Works."

Thank you for any information you might be able to send.

R. B. Wetzel,
Square & Marra Construction Co.,
4990 Massachusetts Avenue,
Indianapolis 18, Indiana.

Editor's note: We do not have any extra copies of the article on exfiltration testing that appeared in PUBLIC WORKS, Aug., 1946.

BETTER STREET NAME SIGNS

In reading Mr. Hensley's excellent article on the reduction of traffic congestion I feel that he missed one very important item, namely street name signs. I do not know if the condition exists in his locality but here in California it is a reasonable guess that at least 20 percent of the drivers on the streets are strangers to the district in which they are trying to find their way. They, therefore, in the belief that they are approaching the side street for which they are looking, proceed down the arterial or main street in a hesitating fashion, at a speed of

When Cities Go Modern...

CLAY PIPE SEWERS GO IN

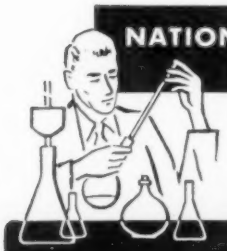
CORAL GABLES, FLORIDA, had a population of only 8,300 people in 1940. Today, the population has zoomed to more than 30,000—and public health facilities are being modernized to meet this amazing growth. A 259,000-foot bond-financed sewerage system, costing $3,372,000, is being installed.

Vitrified Clay Pipe is the safe choice of city officials, because it's sure to give dependable, trouble-free service long after the bonds are retired.

Clay Pipe is not only the *safe* material, but the practical material for municipal sewerage. A wide variety of new jointing methods and materials, developed through Clay Pipe research, insure a system that holds infiltration to a minimum, even in Florida's high-water-table areas. And Clay Pipe is the economical material, because its cost-per-year-of-service is the lowest. Where public health is at stake, why take chances on substitutes? Specify and install Vitrified Clay Pipe . . . guaranteed for 50 years.

FOR CORAL GABLES, FLA.—W. T. McIlwain, City Manager
CONSULTING ENGINEERS—M. B. Garris and Associates, Coral Gables, Fla.
CONTRACTORS—Smith and Gillespie, Jacksonville, Fla.

Vitrified CLAY PIPE NEVER WEARS OUT! PIPE



NATIONAL CLAY PIPE MANUFACTURERS, INC.
1820 N. Street, N.W., Washington 6, D. C.

206 Connally Bldg., Atlanta 3, Ga.
100 N. LaSalle St., Rm. 2100, Chicago 2, Ill.
703 Ninth & Hill Bldg., Los Angeles 15, Calif.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio

C-256-1

Progress in Public Health - Through Clay Pipe Research

JACKSON VIBRATORY COMPACTORS

TERRIFIC TIME SAVERS ON ALL THESE APPLICATIONS:

BACKFILL TAMPING

BLACKTOP PAVEMENT PATCHING

The manually guided Jackson Vibratory Compactor delivers up to 4200 2-ton blows per minute, is self-propelling and will compact bituminous mixes in 5" layers close to maximum density at the rate of 1800 sq. ft. per hour. Operated from a power plant mounted on an auto trailer with device for quickly picking up and lowering the compactor, this is positively the most advantageous outfit ever offered for patching blacktop pavement, paving drives, walks and similar applications.

It's equally efficient in compacting granular soils in bridge approaches, water, sewer and gas mains and laterals, sub-bases of pavement widening projects, sub-bases of concrete floors, in trenches (interchangeable bases from 12" to 26" available), and dozens of similar applications. 100% of specified density is readily achieved in 10" layers. The Power Plant is fully capable of operating two of these compactors simultaneously and in many instances labor costs can be cut in two by use of the twin-unit shown at right.

CAMPACTING IN TRENCHES, ETC.

MACADAM CONSTRUCTION

For consolidating base courses of rock, slag, gravel and sand in waterbound and penetration macadam construction the Jackson Multiple Compactor is indeed outstanding. It is used on practically all of the important paving jobs in the nation. By all means write for the complete facts.

TWIN UNIT ▲ DOUBLES PRODUCTION

JACKSON VIBRATORS, INC.
LUDINGTON, MICH.

perhaps 15 miles per hour. In looking for a given address they may be unsure whether to turn right or left. Assuming that they do know they must turn left they must take an early opportunity in heavy traffic to make their way out to a lane from which it is legal to turn left and there they mope along for maybe 5 or 7 blocks before they find the proper turn. Being out in the center of the street they have additional difficulty in reading the conventional street signs with their 3½-inch or 4-inch letters. They often end up missing the turn and are lucky if there is a next block to go around to get back to it. There is danger in this too because a man searching all over for a street sign necessarily diverts his attention from other traffic.

May I suggest therefore that an adequate sign system would place signs made in large clear letters some distance before the intersection, perhaps 75 ft. They should show the name, block number, and if possible the following street name, thus

WALNUT 900W
Jackson

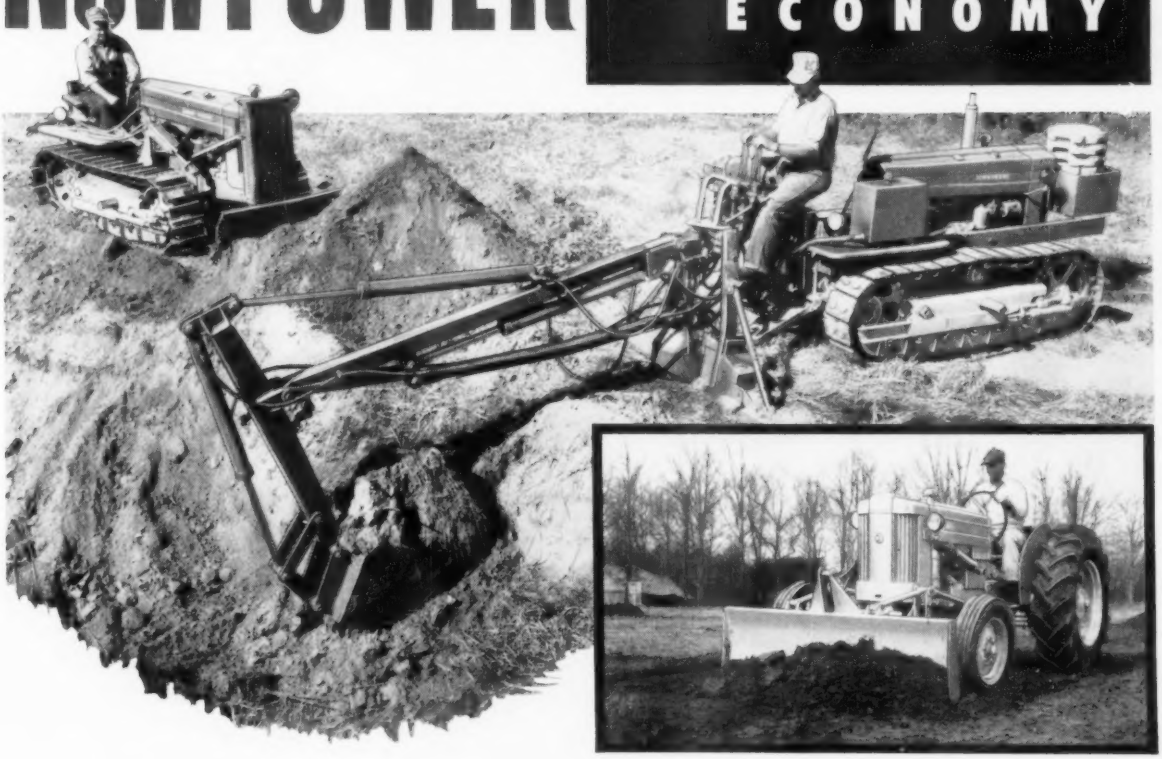
Long Beach, Calif., has, since the end of World War II, completed a comprehensive job in which all the signs were placed at exactly the same height and as near as possible the same relative position with the result that many of the signs are not visible from a driver's position, being hidden behind power poles and traffic signals. The main street and the side street names, being at the same height (to save cost of extra clips), the one blocks out the other. San Francisco has placed the two signs one above the other and they are very clear.

A further refinement would be a logical grid numbering system and the elimination of named streets from a series of numbered streets which might help a stranger in San Francisco where, going down Market street, he finds Annie and New Montgomery mixed in with 3rd, 4th and 5th; or in Long Beach where between 1st and 7th you find Broadway, Vista, Mariquita and Colorado and in the same manner to the north city limits beyond 53rd Street.

Finding one's way at night is another problem. I once spent four hours trying to find my daughter's home in the outskirts of Tacoma, Wash. It is expensive to illuminate street signs, though Washington, D. C., made an attempt at it; but I notice I have no difficulty in reading all the advertisements at night for they are reflector type or "Scotchlite" which shows up clearly.

Need more facts about advertised products? Mail your Readers' Service card now.

New POWER ... TIME-PROVED JOHN DEERE ECONOMY



Everywhere . . . on all types of work . . . John Deere "40" Series Crawler and Wheel-Type Tractors have been making good with contractors, municipalities, and industrial users.

Now, the new "420" Series Tractors, *with 20 per cent more power,* offer you even better performance, even lower costs per job.

Here is the compact, rugged construction, the dependable day-in-and-day-out performance that enables you to get more work done in a given period.

Here is the all-around economy—fuel economy . . . oil economy . . . maintenance economy that sets new high standards—economy that means real dollars-and-cents savings, more profit each year of the tractor's long life.

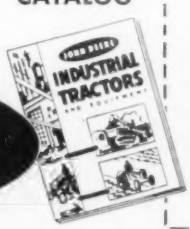
Top: HANDYMAN "420" CRAWLER . . . 25 drawbar h.p. . . . 4- and 5-roller sizes . . . little giant in work capacity. Shown with backhoe, one of its many matching tools.

Above: HANDYMAN "420" UTILITY . . . the low-built, highly maneuverable wheel-type tractor for all-around work. Three-point hitch regular. Shown with front-end dozer.

Here is wide, all-around adaptability to jobs of all kinds, with a great matching line of John Deere and allied working equipment.

There is a John Deere dealer near you. Ask to see the new John Deere "420" Tractors.

Send for FREE CATALOG



JOHN DEERE • Moline, Illinois • Dept. D66D

Please send me latest literature on your "Handyman" Industrial Tractors.

Name _____

Title _____

Firm _____

Address _____

City _____ *State* _____

JOHN DEERE
Industrial TRACTORS and Equipment

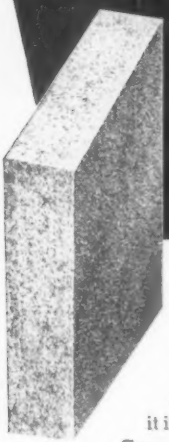
It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

When Concrete joints must be kept filled

Specify and Use

SERVICISED

SELF-EXPANDING CORK



1. Expands as much as 50% beyond original thickness after compression
2. Non-extruding
3. Resilient

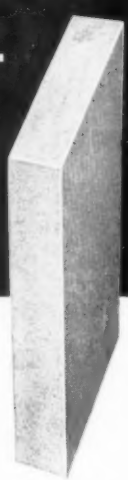
Servicised Self-Expanding Cork Joint provides *maximum joint filling* regardless of concrete movement because it is specially treated to expand to 150% of original thickness. Composed of granulated cork and synthetic resin binder molded under heat and pressure. Widely used in tunnels, outlet works, spillways, stilling basins, sewage treatment works and water filtration works.

When joints in exposed concrete must be inconspicuous...

Specify and use Servicised

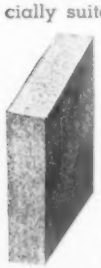
SPONGE-RUBBER

CEMENTONE®



1. Blends with color of concrete
2. Fully resilient
3. Non-extruding

Servicised Sponge Rubber Cementone Joint is composed of high quality blown sponge rubber of uniform thickness and density. Gray in color, it blends with concrete to provide a fully resilient, inconspicuous joint filler. Especially suitable for bridges, viaducts, pre-cast concrete wall panels.



SERVICISED STANDARD CORK EXPANSION JOINT

Similar in composition to Self-Expanding Cork, Standard Cork Joint has a very high recovery rate after compression —95%. It is light in color and will not extrude under compression.

Write for the Servicised Catalog. It has complete details on Servicised Premolded Joint Fillers.

SERVICISED PRODUCTS CORPORATION

6051 WEST 65th STREET • CHICAGO 38, ILLINOIS

Now's the time to mail this month's Readers' Service Card.

Grid numbering systems can be logical or confusing but in most cases they are a distinct improvement over conditions in New York City which seems to have nearly perfect conditions for a grid but Fifth Avenue and 1500 Broadway are both not far from 42nd Street. Grids must contain some element of confusion in Los Angeles with its parallel sets of streets in three main directions; in fact, in any triangular city, or one with wandering streets like Norfolk, Va.

It may be that lack of adequate signs was tolerable when people lived in a city for a lifetime, but with a population constantly on the move in strange territory it introduces an amazing degree of viscosity into traffic movement.

As to "STOP" signs, they undoubtedly accelerate traffic on the protected street but do have tendency to concentrate traffic on that street. Seeing, however, that a driver must see a stop sign it should be an invariable rule that the name of the street he is stopping for should be immediately below the sign:

STOP
State Street

is much more helpful than

STOP
Arterial

and any city setting up signs should get a stranger who does not know it to lay out the job. A man who knows the city does not often see the stranger's difficulties.

Leonard R. Incledon,
Chief Engineer,
Installation Engineer's Office
George Air Force Base, Calif.

Editor's note: Mr. Hensley's article entitled "Ways to Reduce Traffic Congestion" appeared in the October, 1955 issue of *Public Works.*

CONSTRUCTION PROGRESS CHARTS

It is the desire of the Commissioner of Public Works to establish a chart system, whereby the current status of all County Contracts may be readily seen. This would encompass reference to budget, acquisition, design, bids, construction phases, and difficulties encountered in any of the foregoing. Maintenance would be on a monthly basis. Any information you may have, or references to similar projects, would be greatly appreciated.

Arthur Freed,
County of Westchester,
Department of Public Works,
County Office Building,
White Plains, New York.

Introducing

The GAR WOOD SPEED-PACKER

For the *first time* a continuous loader that

- ...crushes and shreds refuse
- ...really compacts the load
- ...eliminates selective loading
- ...keeps maintenance costs low
- ...combines speed with safety

GREATER PAY LOADS PER CUBIC YARD OF CAPACITY

CRUSHING plus PACKING

A Gar Wood SPEED-PACKER

There's a new high in refuse collection service in store for you with the Gar Wood Speed-Packer. This outstanding unit is designed to *crush* and *pack* all kinds of refuse . . . handle *far bigger pay loads* than have ever been considered possible!

Because refuse is crushed before it is packed, the Speed-Packer handles maximum loads every time. Greater compaction means fewer trips to the dump and the ability to maintain far more efficient collection schedules.

The Gar Wood Speed-Packer was designed and built by the company that pioneered packing-type refuse collection units. The experience

Non-selective loading

The only continuous loader that loads, crushes and compacts almost any material

# of refuse

GarWood

Exclusive

gained in building Load-Packers for more than 2600 municipalities is your assurance of the quality and performance now reflected in the Speed-Packer.

But that's not all! The continuous loading Speed-Packer has a long list of advantages over other continuous-type refuse collectors. It handles almost any material . . . there's less maintenance . . . it's convenient and safe to operate. And there's a choice of either 16 or 20 cu. yd. models.

Add it all up. For far bigger pay loads . . . for better, more economical refuse collection . . . the Gar Wood Speed-Packer tops them all!

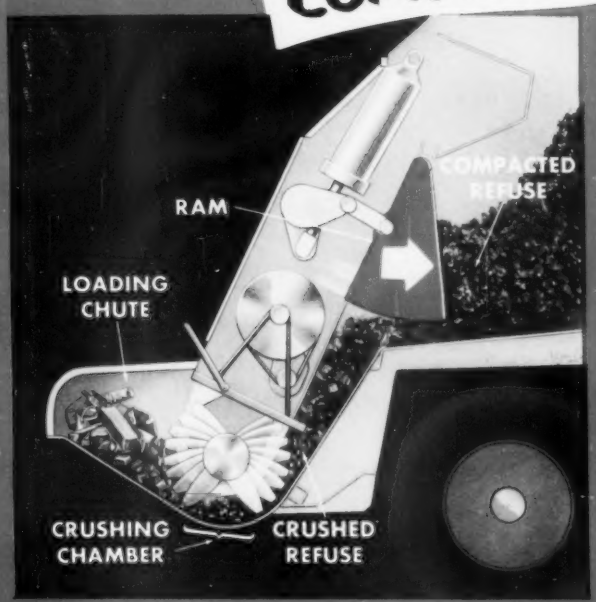
Unlike escalator-type collection units, the Speed-Packer is a non-selective loader. It loads, crushes and compacts almost any material . . . wooden crates, tin cans, bottles, discarded metal toys, automotive tires, building materials such as bricks or cinder blocks, lumber of all sizes and shapes, tree limbs and heavy brush . . . even those extra long branches . . . anything the Speed-Packer can get its "teeth" into. Materials disappear just as fast as two men can fill the low, wide loading chute. There's no waiting, no delay. Collection crews can maintain a faster pace.

First it CRUSHES

POWERFUL CRUSHING FORCE

reduces refuse, eliminates voids by shredding and crushing, makes the load easier to compact. 46 heavy duty crushing teeth exert plenty of force to handle almost any material with ease.

...then COMPACTS



DIRECT PACKING ACTION

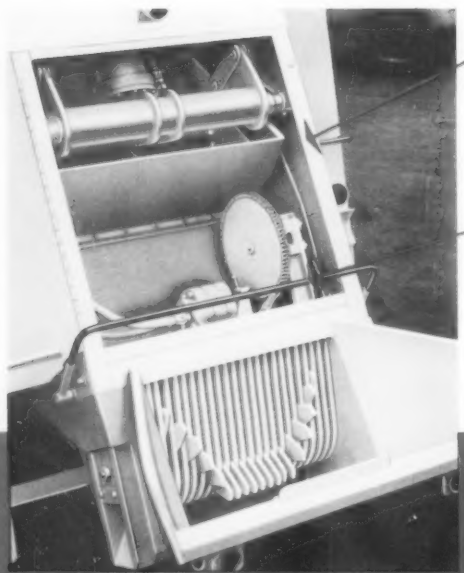
compacts refuse after crushing teeth have distributed material across full width of Speed-Packer body. Packing ram is low where it compacts entire load with a forward action for bigger pay loads.

You'll benefit from

... low maintenance costs

... collection speed combined with safety

... in the Gar Wood SPEED-PACKER



A new low in MAINTENANCE

Simplified design and rugged construction mean extra long life. Replacement parts cost less . . . all drive units are completely enclosed and protected . . . there's no contact with refuse or exposure to the weather.

A new high in SAFETY

Collection crews work in greater safety. Powerful crushing takes place deep down in the hopper for maximum crew protection . . . eliminates possibility of crushed materials flying back. And just a slight touch on this safety control bar stops or reverses teeth instantly.

plus many more outstanding performance features

Short wheel-base requirements for maximum maneuverability • Dependable, long-life hydraulic system for better operation • Large safety riding steps reduce crew fatigue • Fully enclosed for leakproof, oderproof collection • Simplified installation reduces cost of chassis changes • Nation-wide parts and service through Gar Wood-St. Paul distributors

Specifications

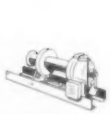
MODEL	RATED CAPACITY	CA DIMENSION—Single Axle	CA DIMENSION—Tandem Axle
SP-416	16 cu. yds.	102"	102"
SP-420	20 cu. yds.	135"	131"

GAR WOOD INDUSTRIES, INC.

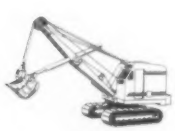
Wayne, Michigan • Richmond, California

Plants in Wayne and Ypsilanti, Mich.; Findlay, Ohio; Mattoon, Ill.; Richmond, Calif.

Gar Wood Truck Cranes



Gar Wood Winches



Gar Wood Excavators

Gar Wood-Buckeye Ditchers

Gar Wood Load-Packers

Gar Wood-Buckeye Spreaders

Gar Wood—St. Paul Hoists & Bodies

Two of the thousands of Barber-Greene Tamping-Leveling Asphalt Finishers which set the standard for quality, speed and economy in asphalt paving.

Jobs don't have to be selected for the Barber-Greene Finisher

The Barber-Greene Finisher is not limited in the types of jobs it can handle. It takes them all in stride. Here's why:

Top Paving Speed: The Barber-Greene will lay any mix at operating speeds as fast as any paving machine now in use. Speeds have only been restricted by surface quality standards. Competitive claims to the contrary, experience has shown that the Barber-Greene will lay as fast with the same surface quality.

Positive Traction: A finisher must maintain traction and steering control while pushing loaded trucks up steep grades, on slippery primes, on soft bases. Barber-Greene's crawler mounting assures this positive control.

Superior Maneuverability: Short over-all length and crawler mounting save valuable time in fast maneuvering or turning around, even in narrow streets or confined areas.

Ease of Control: The operator has an unrestricted view of truck dumping, material level at spreading screws, and finished mat.

Time-Saving Hopper: The receiving hopper is amply wide for fast truck changes and easy discharge, without spillage. It automatically feeds the spreading screws. No hand shoveling required.

World-Wide Parts and Service: Barber-Greene parts and service are available from local stocks on short notice, all over the free world.

See how this preferred finisher will cut your costs. Write for literature.

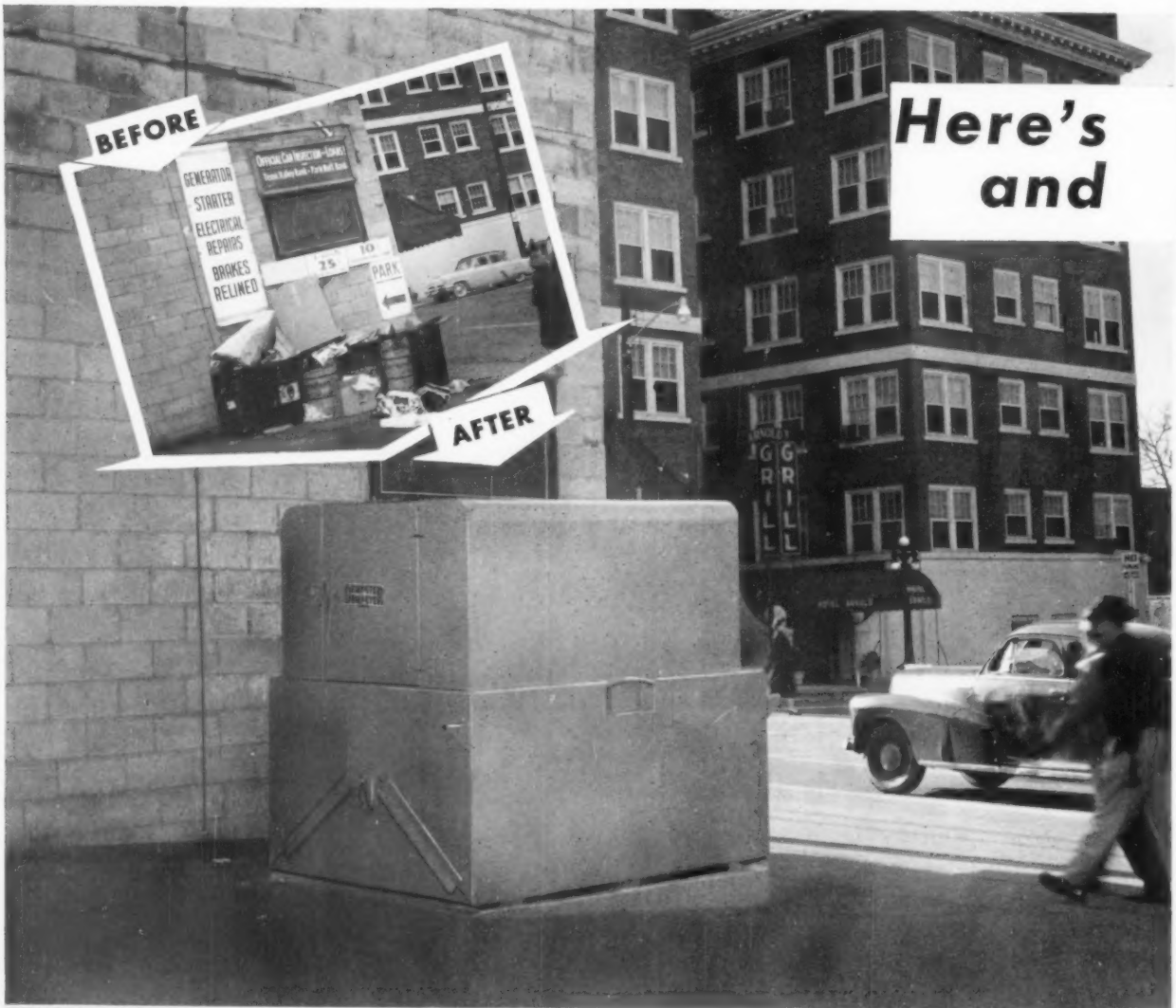
56-6-F

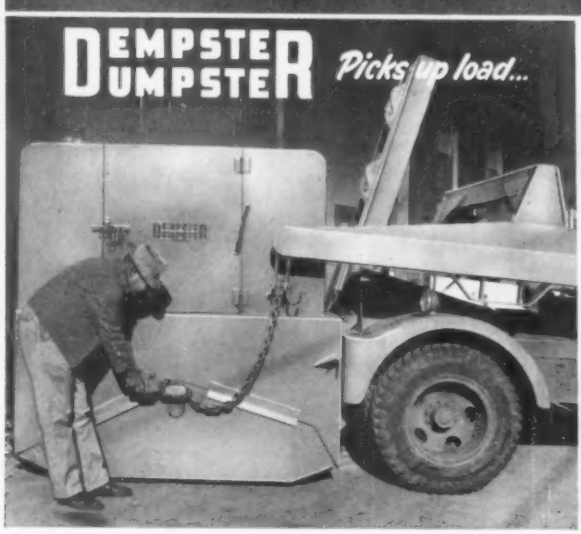
Barber-Greene BG

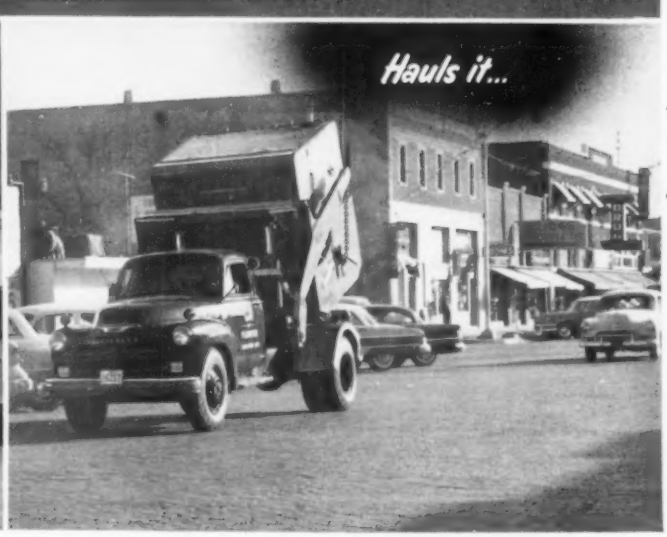
AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

Now's the time to mail this month's Readers' Service Card.







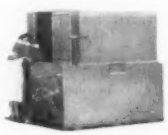
5204

DEMPSTER

the solution to unsanitary costly bulk refuse collection...

... a simple, economical and nationally recognized solution to the problem of open cans, crates, etc, with overflowing loose refuse - - a costly potential in disease and fire hazards alone in damage to persons and property!

BIG STEEL DEMPSTER-DUMPSTER CONTAINERS—each equivalent to 75 ordinary trash cans—can be located at convenient bulk refuse accumulation points in your business areas . . . in housing and apartment areas . . . at schools, hospitals, etc. Scores of them—25, 30, 40, 50—served on pre-arranged schedule by only one man, the driver of your truck-mounted Dempster-Dumpster.



Invariably, wherever this system is installed, one finds immediate praise of an outstanding improvement from merchant users and citizens alike. Without question, the Dempster-Dumpster System is recognized as the most sanitary and lowest cost method of bulk refuse collection ever devised.

Without obligation on your part, our engineers will be glad to make a comprehensive fact-finding survey to determine the savings you can expect by the use of this amazing system. For instance, a year ago the system was installed at Borger, Texas "and has proven to be the answer to our trash and garbage problems in the business districts", writes City Manager Fritz Thompson. Now, it is being enlarged and Mr. Thompson confirms what our original survey pointed out that the Dempster-Dumpster equipment is being amortized out of labor savings alone in approximately four years. In nearby Plainview for another example, Mayor C. L. Abernethy tells us "We have found, as your original survey pointed out, that the labor savings alone will amortize the cost of the Dempster-Dumpster System within the first three years of its operation." Plainview has one Dempster-Dumpster serving 58 containers. Write us today! Dempster Brothers, Inc.

Dumps it...

HERE ARE A FEW OF THE SCORES OF CITIES, LARGE AND SMALL, USING THE DEMPSTER DUMPSTER® SYSTEM

Atlanta
Baltimore
Davenport, Iowa
Henderson, Ky.
Jackson, Tenn.
Lakeland, Fla.
Lubbock, Texas
Pampa, Texas
Wilmington, N. C.
Richmond, Va.
Rochester
New York City
Denver
Montgomery, Ala.
Odessa, Texas
Wyandotte, Michigan

BROTHERS 936 Dempster Bldg., Knoxville 17, Tenn.

FREE EQUIPMENT DATA to Help Your PUBLIC WORKS PROGRAM

NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field.

Continuous Analyzer For Free Residual Chlorine

38. Literature on the new residual chlorine analyzer, that provides an automatic check on Cl_2 content in chlorinated water, is available from Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, Penna. Complete equipment needed, performance characteristics and method of operation are fully covered. Check the reply card.

Information on the Handiest of All Power Tools

40. The new Lincoln Weldanpower is explained fully in a bulletin just released by The Lincoln Electric Co., Cleveland 17, Ohio. The Weldanpower supplies 200 amps AC welding current for fast, easy welding, hardsurfacing, soldering, brazing, torch heating and current. It also can be used as an AC power unit for continuous duty or standby power. Check the handy card today.

Uses and Erection Data of Barrier Beam Guard Rail

46. Typical installations, erection instructions, specifications, curving data and physical properties of the barrier beam guard rail are fully covered in the catalog available from United Steel Fabricators, Inc., Wooster, Ohio. Plenty of photographs and drawings are included. Check the reply card.

Concrete Bridge Details

58. An illustrated 48-page booklet, published by the Portland Cement Association, 33 W. Grand Ave., Chicago 10, Ill., calls attention to good and poor practice in bridge building. It also shows how to improve improper details and open the way for use of higher stresses. Write to PCA for your copy or check the reply card.

How to Prepare and Maintain Roadways With Calcium Chloride

65. "The Calcium Chloride Road," is the name of a new 24-page two-color catalog issued by the Columbia-Southern Chemical Corp., 632 Fort Duquesne Blvd., Pittsburgh 22, Pa. Included are sections on dust control, gradation, placing and mixing materials and shaping. General information on spring, summer and fall maintenance is also provided. Check the handy reply card.

A 1-Bag Capacity Concrete Mixer

72. A catalog describing the Model 6-S Dandie concrete mixer is available from the Kwik-Mix Co., Port Washington, Wisc. Printed in attractive colors, it explains the many construction and operating features of the 1-bag mixer. Also, included is information on other sizes. Check the handy reply card.

Weirand Flume Meters For Water, Sewage and Industrial Wastes

181. An illustrated 8-page catalog, published by Penn Instruments, Div. of Burgess Manning Co., 4100 Haverford Ave., Philadelphia 4, Pa., describes fully transmission meters, indicating and non-indicating transmitters. It also covers new and novel metering arrangements which have not heretofore been generally used in water and sewage plant installations. Check the reply card.

A Completely Hydraulic Ladder

269. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included. Check the reply card today.

Weed and Brush Control Manual

334. This 16-page manual lists the different types of weeds and brush, when to apply the herbicide, material to use for control, rate of application per acre and gallons of spray per acre are fully covered. For your copy write to Niagara Chemical Div., Food Machinery and Chemical Corp., Middleport, N. Y., or check the reply card.

Information on Open Steel Mesh For Bridges

337. A 28-page catalog on open steel mesh pavement for bridges has just been released by Irving Subway Grating Co., Inc., Long Island City 1, N. Y. Design data, construction and maintenance procedures and where the decking can be used are fully covered. Check the reply card.

What You Should Know About 6-Wheel Trucks

203. Full information on 6-wheel trucks, both conventional and cab-over-engine models, is contained in a new 24-page catalog now available from Motor Truck Div., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Full color and two color treatment are employed throughout the catalog to present design and operating features of the many different lines of trucks. To get your copy of this valuable catalog check the handy reply card today.

Water Treatment For the Small Municipality

348. This bulletin is of special interest to the engineers of small municipalities. A review of the problem of municipal water supply is discussed along with the design of a water treatment plant and the conventional treatment methods. For your copy write General Filter Co., Ames, Ia., or check the handy reply card.

omputers For Solving Complex Engineering Problems

185. General purpose computers that are efficient for solving lengthy and complex problems of research and engineering organizations are fully covered in catalog available from Bendix Computer Div., Bendix Aviation Corp., 5630 Arbor Vital St., Los Angeles 45, Calif. Earthwork problems, analysis of origin and destination surveys, road inventories and traffic flow and control are few of the calculations that can be made. Check the reply card.

Valuable Bulletin on Rodney Hunt Sluice Gate

61. Sluice gate seats on a resilient rubber seal flush with the bottom of the channel and eliminates bottom wedges and the trough in which they descend. Gives design flexibility in water filtration, sewage treatment and sluices, dam, channel and chamber flow control. For complete details write to Rodney Hunt Machine Co., 82 Lake Street, Orange, Mass. for Bulletin 75, or check the reply card.

Valuable Catalog on Steel For Highways

302. A catalog that every engineer should have on the use of steel for highways is available from the Bethlehem Steel Co., Bethlehem, Pa. Design data and specifications on wire rope, culvert pipe, anchor bolts, piling, reinforcing bars, bridge flooring, steel shapes, guard posts and guard rail are included. Check the handy reply card today.

High-Quality Pipe From "Bakelite" Polyethylene Compound

313. An attractive 8-page catalog on the New "Bakelite" polyethylene compound that brings high-quality pipe for water systems has been released by Plastics Dept., Union Carbide International Co., 30 East 42nd St., New York 17, N. Y. Sizes, properties, uses and working pressures are included. Check the reply card.

Effective Warning Signals Help Safeguard Communities

374. Nation-wide encounters with floods, windstorms and fires have demonstrated the multiple advantages of air raid warnings and signal systems as a means of summoning civil defense and rescue squads to deal with natural disasters. Get complete information on efficient size and spacing of sirens from Federal Sign and Signal Corp., 8733 So. State St., Chicago 19, Ill. Check the reply card.

Complete Information on All Types of Graders

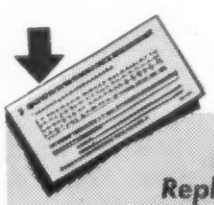
396. Literature is now available from Huber-Warco Co., Marion, Ohio, on the different types of motor graders available from this company. The exclusive features, general specifications and power plants are fully described. Check the handy reply card.

Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y.

Easily Cleaned, Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.



Use the Reply Cards Inside Front Cover

In Price Purchasing

THE DOWN PAYMENT
MIGHT BE THE ONLY EASY ONE

The purchase of water meters involves more important economic factors than price alone. Actually, the bid price is only your down payment . . . and it could well be the only easy payment.

Any instrument loses its accuracy as it wears. After a few years . . . maybe only a few months . . . an improperly selected meter begins to lose revenue. In time, you'll also have high repair costs . . . or costly scrap-and-replace programs.

Avoid these high costs with Trident meters. Tridents retain accuracy longer . . . derive maximum revenue longer. Most important, you avoid high costs of obsolescence and repair. The most modern Trident parts fit the oldest Tridents you have. You actually modernize as you repair . . . with Trident.

When you consider all these economic factors you will quickly see why Trident meters earn more and cost less. Ask your neighbor . . . or ask us to supply verified evidence.

NEPTUNE METER COMPANY
19 West 50th Street • New York 20, N. Y.

NEPTUNE METERS, LTD.
1430 Lakeshore Road • Toronto 14, Ontario

Branch Offices in Principal American and Canadian Cities

neptune

257

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

To order these helpful booklets check the reply card inside front cover.

Chemicals for Complete Weed Control

79. "Ureabor" weed and grass killer completely destroys vegetation about fence lines, parking lots, storage areas and similar places. Ease of application and maximum long-lasting results make this material the choice where a nonselective herbicide is required. For latest data write Pacific Coast Borax Co., 630 Shotto Pl., Los Angeles 5, Calif. or check the coupon.

Helpful Reference on Swimming Pool Equipment

87. A complete reference catalog of swimming pool supplies, chemicals and equipment is available from Modern Swimming Pool Co., Inc., 1 Holland Ave., Dept. PW, White Plains, N. Y. Detailed information covers filters and accessories, all types of fittings and equipment and helpful suggestions on chemical treatment and pool maintenance. Get your copy of this 44-page book by checking the coupon.

Slide Rule Solves Pump Problems

130. A limited supply of the Peerless hydraulic slide rule is available to engineers. Head, capacity, horsepower and efficiency all appear in one setting. Check the card or write Peerless Pump Division, 2005 Northwestern Ave., Indianapolis 8, Ind.

Fluorescent Street Lighting For the Whole Community

128. Literature on the 5 new G-E fluorescent luminaires, each designed for a different area, is available from Section 452-166, General Electric Co., Schenectady 5, N. Y. Fluorescents for residential, secondary and primary traffic, main streets and whiteway areas are fully described. Features to simplify installation, lower maintenance and to give maximum performance are explained in drawings and photographs. Check the handy reply card today.

Information on Rigid Roll and Pneumatic Compaction

155. This compaction unit offers pneumatic compaction through oscillating, spring-mounted wheels and rigid roll compaction by rubber-tired rolling. The roller can be used independently or together and offers full power hydraulic steering through 180°. Catalog is available on complete specifications and details from Seaman-Gunnison Corp., 201 Lynn Ave., Baraboo 13, Wisc., or by checking the handy reply card.

A Gasoline Engine For Many Municipal Jobs

161. Catalog on a power packed 2-cycle gasoline engine that is designed to do many municipal jobs is available from Mall Tool Co., 7752 South Chicago Ave., Chicago 19, Ill. Information on how this lightweight maneuverable engine can power a dozen attachments is included. Check the reply card.

Complete Information on Portable Electric Plants

202. New power-packed electric plants that are smaller and easier to move around are fully described in literature available from D. W. Onan & Sons Inc., 3682 University Ave., S. E., Minneapolis 14, Minn. Applications, specifications and optional equipment are covered. Check the reply card.

The Principles of Compaction by Vibration

203. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif. Check the handy reply card.

WATER WORKS

Water Level Controls for Sewage and Water Plants

31. Dependable float-operated pump and motorized valve controls for single or multiple pump installations are described in bulletins issued by the Water Level Controls Div., Healy-Ruff Co., 719 Hampden Ave., St. Paul 4, Minn. All units feature splash proof construction, mercury tube switches. Check the reply card.

Data on Cutting-In Valves, Repair Sleeves and Accessories

33. A variety of Clow products for installation and repair of cast iron pipe lines, including the Eddy cutting-in valve and sleeve, split sleeves for pipe repair, test plugs, valve boxes, Strickler pipe cutters and other fittings and accessories are featured in literature available from James B. Clow & Sons, Inc., Box 6000-A, Chicago 80, Ill. Check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

100 Page Book Helps Solve Water Problems

71. pH and Chlorine Control. A discussion of pH control and description of comparators, colorimeters and similar devices. A 100-page booklet is available by checking reply card W. A. Taylor Co., 7304 York Road, Baltimore 4, Md.

Design Data on Chemical Flocculating Equipment

89. Flash mixers, Straightline mixers, conveyors and elevators for handling chemicals are described in illustrated Bulletin No. 2442 available from Link-Belt Co., Colmar, Pa. Selection tables and diagrams are provided to help you select the equipment best suited to your needs. Check the reply card for your copy.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

It's True There are Other "Good" PIPE DETECTORS

and EACH ONE WILL PERFORM ALL THESE JOBS:

- Detect, trace and center pipes, cables, etc.
- Estimate their depth
- Separate parallel pipes, cables, etc.

Model 505 Pipe Detector

But... Do They Have ALL These "505" Features

1. ALUMINUM CASE shields the loops from outside interference and is light — durable — repairable.
2. BUILT-IN BATTERY TESTERS plus 67½ V batteries insure maximum service, more efficiency, more power.
3. QUICK-ACTION ALUMINUM HANDLE set up in seconds for one man operation.
4. LIFETIME GUARANTEE assuring reliable performance for the entire life of instrument.

Also Available: Model 505-C Combination Pipe-Leak Detector

Get the complete "505" story — write Dept. 55.

Detectron COMPUTER-MEASUREMENTS CORP.
Utilities Instrument Division
5528 Vineland Avenue North Hollywood, California

PALMER

ANTHRAFILT FILTER MEDIA

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

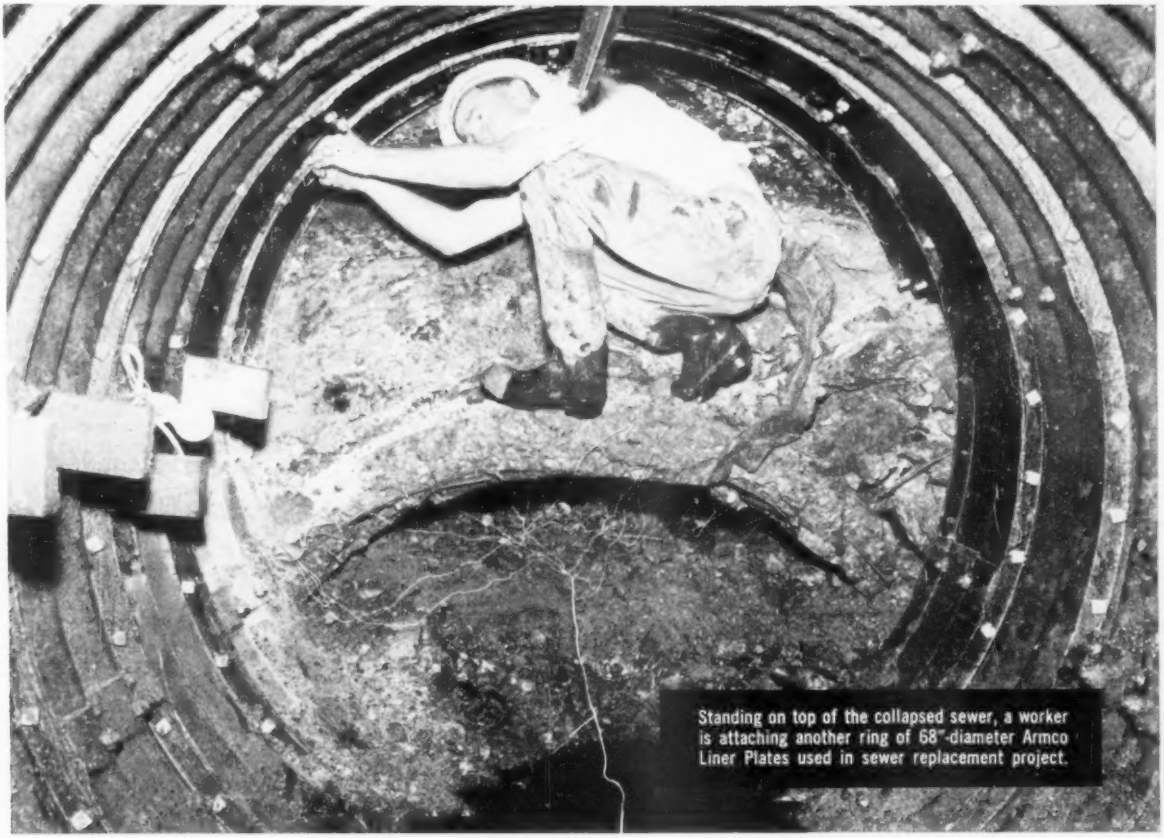
PALMER

FILTER BED AGITATORS

FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. • Erie, Pa.



Standing on top of the collapsed sewer, a worker is attaching another ring of 68"-diameter Armco Liner Plates used in sewer replacement project.

Armco Liner Plates replace failed sewer under football field

Students of Lawrence Park Collegiate, a school in Toronto, Canada, were surprised one day last year when they found a section of their football field collapsed. The cave-in was caused by failure of a sewer under the field.

R. V. Anderson and Associates, Ltd., consulting engineers of Toronto, were asked to inspect the damage and recommend corrective measures.

It was found that a 72-inch-diameter rigid section sewer had fractured and completely collapsed. Replacement involved two choices—excavate about 25 feet of earth and make replacement by open cut, or tunnel out the failed structures and install a new sewer through this tunnel.

They chose the tunneling method, and Armco Liner Plates got the job.

A shaft was sunk midway between the ends of the failed sewer. Working from each direction in the shaft and both ends of the sewer, Armco Liner Plates were installed at the rate of 6 to 9 feet per day from each of the four headings. Total length of the new tunnel was 561 feet.

Many Municipal Applications

Other municipal uses for Armco Liner Plates include: underpasses for streets and railroads, utility conduits, new sewers as well as lining existing structures—especially when disturbing surface installations is impractical, inconvenient or too costly. Write us for details. Armco Drainage & Metal Products, Inc., 4116 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

ARMCO LINER PLATES

ARMCO®

Thousands use our Readers' Service card to keep up to date . . . do you?

Engineering Information and Water Distribution Products

49. Helpful engineering information, covering water distribution problems, is available from Mueller Company in their W-96 Water Works Catalog. The 328 page catalog features a quick reference sectional indexing arrangement for easy location and identification of the hundreds of water distribution and service products illustrated. Check the reply card and you will receive detailed information on a complete line of water works equipment.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Semi-Automatic and Step Control Chlorine Feeding

160. A bulletin, complete with photographs and typical installation and control arrangement diagrams has been released by Builders-Providence, Inc., Providence, R. I. Applications of semi-automatic and step control chlorine feeding are discussed and the main advantages are included. For your copy check the reply card.

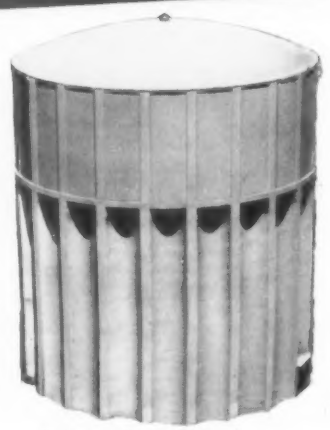
What You Should Know About Fluoridation

217. A helpful publication entitled "Fluoridation" which describes the development of fluoridation and lists the chemicals and dosages normally used has been prepared by Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Copies of publications on both solution and dry feed W&T Fluoridators are also available. These publications are yours for checking the reply card.

THIS PRELOAD tank

"Rides on Rubber"

To eliminate friction and to reduce restraint at the base of the tank wall which causes vertical bending moments, the wall rests on giant rubber pads. A rubber water stop passes between the footing and wall. These features lick the twin major problems of permitting the wall to move inward or outward due to prestressing and changes in water level and leakage at the base joint. Our Report 1-A gives interesting illustrated details on these features.



2-million gallon prestressed concrete tank on 83' tower at Dallas.

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PRELOAD through its own sales engineers or through the licensees is available for consultation. Technical data and literature available on request.

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The Preload Company, Inc.
211 EAST 37th STREET
NEW YORK 16, N. Y.

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Meter Features That Help Make Water Works Profitable

59. Simple design, accuracy and long life, moderate first cost and inexpensive maintenance are features of American water meters described in Bulletin No. 55 of the Buffalo Meter Co., 2917 Main St., Buffalo 14, N. Y. Be sure you have this informative booklet which gives the details of American meter design and construction plus full data on sizes, capacities and dimensions. Get your copy by checking the reply card.

What You Should Know About Pipe Locators

94. A new, up-to-date operating manual for pipe detecting instruments has been made available by the Computer-Measurement Corp., 5528 Vineland Ave., No. Hollywood, Calif. Although written chiefly for the Detectron Model 505, it contains operating hints and other information useful with any make pipe detector. To get a copy just check the reply card.

Discussion of Ranney Method For Municipal Water Production

116. A very interesting study of municipal and industrial water supply problems and a complete discussion of Ranney Collectors for water production will be found in a 20-page booklet published by Ranney Method Water Supplies, Inc., Box 5415, Shepard Station, Columbus 19, Ohio. Water quality, construction methods, costs, performance and other topics are considered. Check the reply card to get your copy.

Standard Specifications for C. I. Pipe and Fittings

278. Standard dimensions for cast iron water pipe and special castings are available in convenient booklets offered with the compliments of U. S. Pipe and Foundry Co., Birmingham 2, Ala. Get your copy by checking the reply card.

Case Histories on Water Meter Installations

283. A factual report of the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters is available from the Ford Meter Box Company, Inc., Wabash, Ind. Monthly meter rates, inspection report cards and various types of pack joint horns and setters are fully described. Check the reply card for your copy.

Factors to Consider in Elevated Tank Selection

299. Details on the several different types of elevated steel tanks, including capacity ranges, tank dimensions and other factors to be considered in the selection of elevated tanks for modern water storage, plus discussions of new tanks for old towers and foundations are included in Bulletin 101 of the Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. Check reply card for your copy.

Quick Review of Water Meters

316. A helpful condensed catalog which covers sizes and types of water meters for every kind of service is available from Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa. Each type is illustrated and fully described; specifications and prices are included. Gen. Bulletin W-800 by checking the reply card.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa. Get full details by checking the reply card.

Reference Data on the Electric Check Valve

344. Comprehensive data on the Double Cushioned Electric Check Valve which simplifies backflow control at pumping installations is contained in an 8-page technical bulletin, issued by Golden-Anderson Valve Specialty Co., 1244 Ridge Ave., Pittsburgh 33, Pa. Details on valve design for quiet, positive operation, dimensions, wiring arrangements and head loss are included. Check the reply card for Bulletin W-10.

NEW 360 HALF-YARD HOPTO

DIGGER · SHOVEL · CRANE

360° SWING!
FAST CYCLING!

180° BUCKET TILT

LONG REACH—26′

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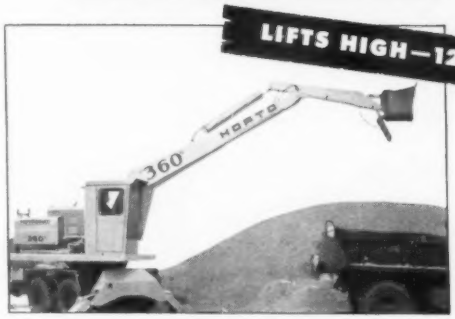
LIFTS HIGH—12′



Here's the completely hydraulic *mobile* shovel that equips you to do more jobs with lower equipment investment . . . *at greater profit!*

The 360 HOPTO swings three hundred and sixty degrees from its over-the-cab travel position. Operator's cab swings with unit for face-forward, *safe* operation. Feather-touch controls actuate every movement from positioning of outriggers to fast-cycling swing and 180° tilt of bucket! Heavy-duty hydraulic system with built-in relief valves gives an easily managed, oil-cushioned, 20 ton force to dipper stick! ! !

Interchangeable backhoes and shovel buckets have H and L replaceable teeth and are available in three-eighths and one-half yard sizes. Check *NOW* on the many advantages of owning this work-hungry, mobile digger, shovel, crane!

Write today for complete information on the '360' or any one of six quarter-yard HOPTO Models!

BADGER MACHINE CO.

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Efficient Underdrains for Rapid Sand Filters

239. Be sure you have engineering data on vitrified clay underdrains, efficiently designed for filtering and backwashing. Check the reply card or write F. B. Leopold Co., Inc., Dept. PW, 2413 W. Carlson St., Pittsburgh 4, Pa.

Equipment for Waste and Water Conditioning Processes

240. Equipment for conditioning of municipal and industrial water and treatment of industrial wastes is discussed in Bulletin WC-117, issued by Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. For your copy check the reply card or write direct to the manufacturer.

Modern Filtration of Swimming Pool Water

351. Latest data on filtration systems for swimming pools of 50,000 gallon capacity and over is presented in 24-page bulletin No. 625 by R. P. Adams Co., Inc., 225 East Park Drive, Buffalo 17, N. Y. Design and operating data are provided, together with material to assist you in choosing the right filter for your pool. Check the reply card for your copy of this helpful bulletin.

Engineering Data on Lubricated Plug Valves

355. Full information on Homestead lubricated plug valves in full-port and venturi types, sizes up to 14", and with a choice of self-sealed two-piece plug or one-piece plug designs. Engineering information includes principal dimensions, types of control, metals, lubricants, etc. For your copy write Homestead Valve Mfg. Co., Coraopolis, Pa., or check the reply card.

Valuable Information On Prestressed Concrete Tanks

356. This helpful booklet describes the design, uses and advantages of prestressed concrete in all types of storage tanks. Plenty of charts, diagrams and illustrations are included. Get yours from Preload Enterprises, Inc., 211 East 37th St., New York 16, N. Y., or check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif. Get latest data by checking the reply card.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Get latest data by checking the reply card.

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Engineering Data on Asbestos Cement Pipe

372. Advantages of corrosion-free asbestos-cement pipe for water distribution plus full data on installation methods, cutting, making connections, testing, dimensions and weights are contained in the bulletin, "Mains Without Maintenance," issued by Keasbey & Mattison Co., Ambler, Pa. Get your copies by checking the reply card.

How to Clean and Develop Water Wells

375. The use of Weltone, which combines the cleaning power of Calgon with disinfecting and other chemicals in a safe, highly soluble powder is described in an interesting and informative booklet. For your copy of this descriptive literature write Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa. or check the reply card.

What You Should Know About Venturi Tubes and Nozzles

400. A comprehensive bulletin, No. 100, of interest to all engineers dealing with the measurement of liquid flow and its various ramifications has been issued by Simplex Valve & Meter Company, Lancaster, Pa. Data on advantages, construction and installation details, range of sizes and specifications are given in simplified form. Check the reply card today for your copy.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long. Check the reply card.

For Prompt Service Use The Reply Card Inside Front Cover

How to Choose the Right Self-Priming Centrifugal Pump

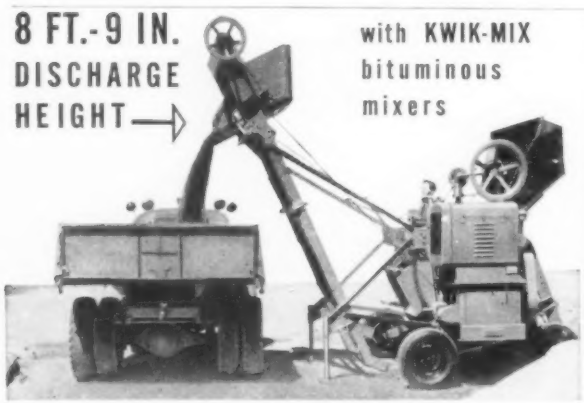
427. Descriptive folders on the complete line of contractors' pumps have been issued by the Gorman-Rupp Co., Mansfield, Ohio. 2-in. to 10-in. models are illustrated, performance tables are shown and pump selection tables are included to assist in choosing the proper pump for different jobs. Check reply card for your copies.

Important Factors in Water Meter Selection

463. Interchangeability of parts is an important advantage that is yours when you use Trident meters. The newest parts fit your oldest Tridents so you modernize when you repair. Get full data on the entire Trident water meter line by checking the reply card or write to Neptune Meter Co., 19 West 50th St., New York 20, N. Y.

8 FT.-9 IN. DISCHARGE HEIGHT →

with KWIK-MIX bituminous mixers



Now you can load bituminous mix into trucks, overhead hoppers, or stockpile, with Tower Loader attachment on Kwik-Mix Bituminous Mixers. Available on either the 10 or 14 cu. ft. mixers, tower provides 7'-9" to 8'-9" discharge height. Big bucket holds full mixer batch, is raised by power, dumps automatically at top of tower. Bucket travel and discharge are completed while next batch is being mixed. No delay to mixer production. It is single-lever controlled, and powered by mixer engine. Tower is hinged for travel clearance. See Kwik-Mix distributor or write.

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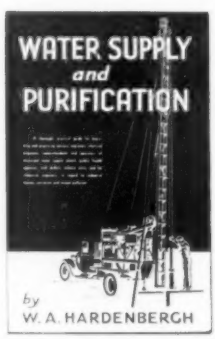

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AN authoritative yet simple treatment of the subject by one of the nation's foremost authorities, whose editorial and field work have brought him in close contact with the problems that trouble the average engineer. Design examples of all kinds are worked out in detail to illustrate practical, up-to-date methods.
Among the major changes introduced in this latest edition are the following: the chapters on ground water, on filtration, and on laying pipe and maintaining lines have been almost completely rewritten; the chapters on pipe conduits and on disinfection have been revised to bring the material in them up to date; and a new chapter has been added on fluoridation.

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Chicago South District Filtration Plant

Years and Years Ahead in PNEUMATIC Instruments and Controls For Water Works Service

Because this equipment is specially designed for water works service, the Builders Pneumatic System is outstandingly successful in operation. Builders Pneumatic Instruments and Controls are now giving top performance on many important installations across the country, including Chicago's South District Filtration Plant, the world's first and largest pneumatically equipped plant, built in 1946.

Builders Pneumatic Meters and Controls are right for water works service in every detail — in accuracy, in range, and in materials of construction. Each system profits by our broad design and manufacturing experience . . . a "plus" service we extend to engineers to help in obtaining the correct instruments and controls for each project. Builders-Providence equipment is backed by our own nationwide organization of service specialists . . . another assurance of economical plant operation.

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CONSTRUCTION EQUIPMENT AND MATERIALS

How to Select Prestressed Concrete Bridge Members

26. Colorful folder, well illustrated, shows manufacture of "Amdek" prestressed bridge members and provides selection tables covering several AASHO loadings. Full data from Concrete Products Div., American Marietta Co., 104 East Ontario St., Chicago 11, Ill. Check the reply card for your copy of this helpful reference bulletin.

Do You Have Complete Black Top Equipment Data?

41. In 36-page catalog AA a full line of maintenance is covered. Units described and illustrated include several models of pressure distributors, supply tanks, sprayers, brooms, asphalt kettles, portable rollers, and accessory tools. Use reply card for copy of this handy manual. Littleford Bros., 452 E. Pearl St., Cincinnati 2, Ohio.

For Fast, Smooth Pipe Cuts

68. Descriptive literature on the Reed 4-wheel hinged pipe cutter which operates in close quarters, gives quick, easy right-angle cuts, and is available from Reed Mfg. Co., Erie, Pa. Check the reply card.

Makes Underground Pipe Installation Easy

115. One-man operated hydraulic pipe pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts ask for Form E-213 Greenlee Tool Co., Rockford, Ill. Just check the reply card.

Self-Propelled Sidewalk Paver Lays Up to 10 Ft. per Minute

117. Bulletin 53, released by Dotmar Industries, Inc., Kalamazoo, Mich., describes the Dotmar paver, which can lay up to 10 ft. per minute of walk when working with transit mix units. Paver is readily convertible to pave curb and gutter, or integral curb, gutter and walk. Get the 8-page illustrated bulletin for full data and reports from users. Just check the handy reply card.

How Accurate Boring Speeds Underground Pipe Installations

135. Interesting charts showing earth boring costs, speed and accuracy for holes from 2½" to 14½" diameter and up to 80 feet long are included in 16-page Catalog No. 8 issued by Hydrauger Corp., 681 Market St., San Francisco 5, Calif. Specifications and general operating instructions are also covered. Check the reply card.

A Tractor-Air Compressor Unit

140. "Around the Clock, Around the World" is the title of an 8-page bulletin describing Le Roi's new 125 Tractair, a self-propelled compressor unit with flexible tractor power. Applications, uses, attachments and tools, design and specifications of the compressor and engine are listed. Write Le Roi Division of Westinghouse Air Brake Company 1706 South 68, Milwaukee 14, Wisconsin, or check the reply card for your copy.

What Equipment is Needed By Modern Community Services

328. The importance of modern equipment in work programs is graphically illustrated in the 16-page booklet "Allis-Chalmers Offers New Economy for Villages, Townships, Counties, Cities, States, Federal." Action photographs span the range of community projects and illustrate tractors, scrapers, graders, power units and their multi-purpose attachments. Get this handsome booklet and review your needs today. Allis-Chalmers Mfg. Co., Tractor Div., Milwaukee 1, Wis. Check the reply card.

Diesel Power for Wheel Tractor-Loader Units

151. All the advantages and economies of diesel power are provided in tractor-loader units of Minneapolis-Moline, Minneapolis 1, Minn. Get latest information on wheel tractors and loaders by checking the reply card. It will help you select units to fit your needs.

Now Every Municipality Can Own a Trencher

173. The low cost of the Blackhawk Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 8 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air. For full details check the reply card.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer. Get your copy of this valuable catalog by checking the reply card today.

"A Complete Package" of Road Building Equipment

261. A new catalog describing the road widener, trench roller and base paver has been released by Blaw-Knox Co., Construction Equipment Division, Pittsburgh 38, Pa. Illustrations, specifications and operation procedures are fully covered. Check the reply card today.

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(EARTH BORING MACHINE)

Designed for maximum control of the reamer. Earth along the pilot bits acts as a bearing to steady the reamer assuring an accurate hole.

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WHEN RED WATER DISAPPEARED...
complaints turned to compliments

In a pleasant western community of about 40,000 population, constant complaints about red water made life miserable for the water superintendent. All that has changed, now that Calgon is on the job. In fact, he tells us "Perfect strangers stop me in the street to compliment me on the crystal clear water this community now enjoys."

Red water has stopped because Calgon* Threshold treatment stablizes iron and manganese dissolved in well water at its source. The red (or black) water problem is licked, and the capital expenditure for a costly iron removal plant avoided.

Calgon is the easy and *economical* way to keep your citizens or customers happy if your well water supply contains iron or manganese.

Calgon engineers with experience in all types of water problems in all parts of the country are at your service. A letter or phone call will put a Calgon engineer to work on your water problem.

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Portable Melting Furnace For Rubberized Joint Sealers

357. The Hauck double jacketed melting furnaces use L-P as a fuel and a high flash point oil for heat transfer to assure close temperature control when melting rubberized joint sealers of all types. All details on this 16-gallon capacity unit are furnished in Bulletin 1081. Check reply card for your copy. Hauck Mfg. Co., 124 10th St., Brooklyn 15, N. Y.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication. Check the reply card for your copy.

Tractors and Equipment for Municipal Use

407. Specifications for the John Deere "40" crawler and "40" utility wheel tractors, together with equipment for loading, dozing, mowing, sweeping and many other operations is covered in a comprehensive illustrated catalog issued by John Deere, Dept. 66B, Moline, Ill. Get your copy by checking the reply card.

Handbook on Hot Rolled Carbon Shapes and Plates

412. A handbook every engineer should have on hot rolled carbon shapes and plates has just been released by United States Steel Corp., 525 William Penn Place, Room 5118, Pittsburgh 30, Pa. Check the handy reply card.

Portable Hoist for Many Public Works Jobs

425. These portable hoists are efficient in the handling of valves, trucks tires, hydrants, drums and general cargo. Has 1000 lb. capacity with power both up and down. For full details write to Hoist Division of Burtchaell Heating Co., 2944 S. E. Powell Blvd., Portland 2, Oregon, or check the handy reply card.

Advantages Offered by Aluminum Building Products

460. Strong, light-weight aluminum sheets and extruded sections offer many advantages on public works structures, including weight savings, corrosion resistance, reduced maintenance and attractive appearance. Applications range from roofs and walls to air conditioning and heating duct systems. For names of building products manufacturers who will work with you write Kaiser Aluminum and Chemical Sales, Inc., Kaiser Building, Oakland 12, California, or check the handy reply card.

How to Select Paints For Every Maintenance Need

467. Selecting the right paint for each maintenance need involves consideration of the service to be rendered, conditions of their use and abuse, and the surfaces to which they are to be applied. To help you determine what to use on various surfaces, an industrial paint index printed in the form of a handy file folder has been prepared by the Tropical Paint and Oil Co., Cleveland 2, Ohio. Get a copy by checking the reply card.

•

STREETS AND HIGHWAYS

Bitumuls Paving Handbook Full of Useful Data

23. The latest edition of the Bitumuls Paving Handbook covers a wealth of practical data on paving methods and materials, road and airport paving specifications and construction details, complete tabular data on asphaltic binder applications and aggregate requirements, condensed Asphalt Institute specifications plus data on Laykold compounded asphalts for flooring, tennis courts, protective coatings and waterproofing. You can have a copy by checking the reply card. American Bitumuls & Asphalt Co., 200 Bush St., San Francisco 20, Calif.

What's Your Digging Problem? Repair Work? Trenches? Footings?

35. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam, work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 140° arc and dig to a depth of 10 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

Uniform Salt and Cinder Spreading at All Speeds

93. Be sure to investigate the hydraulically operated ground drive offered by Baughman to give you the advantages of two drive speeds and uniform distribution of material regardless of truck speed, without the need for power takeoff or transmission. Full data on this and many other features in Form A-380. Baughman Mfg. Co., Jerseyville, Ill.

Grading Can Be Faster, Cheaper and Easier

96. You'll like every feature of the Austin-Western 99H Grader. It has all-wheel drive, all-wheel steer, controlled traction, precision sideshift and a high lift, extreme reach, reversible blade. Get data from Austin-Western Works, Baldwin-Lima-Hamilton Corp., Aurora, Ill., by checking the reply card.

Streamlined Data on Tractors, Scrapers and Power Units

102. The complete line of International Industrial Power products, 73 in all, is described in a new 48-page catalog published by International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Technical data has been streamlined, yet provides abundant descriptive material on each piece of equipment. Check the reply card for the latest on crawler and wheel tractors, scrapers, dozers and related attachments plus International Diesel, gasoline and gas power units.

(*Continued on page 56*)

Twice the Speed and Half the Maintenance . . .

That's typical Performance for

BLAW-KNOX PF-90

Bituminous Paver Finisher

Rubber-tired mounting of the Blaw-Knox PF-90 Bituminous Paver Finisher gives you twice the paving speed with half the maintenance cost of crawler mounted units. Fast paving at up to 60 feet per minute, speedy returns for restarts at 4¼ mph and quick, easy maneuvering allow you to make fast work of every paving job. By eliminating 500 to 600 parts characteristic of crawlers, you will have only half the maintenance of ordinary bituminous pavers.

The PF-90 has proved it can meet the most rigid state paving specifications, too — already more than 30 states have approved it and others are being added every month. It also has the traction to handle boxcar size trucks on rough grades and its big hopper will handle approximately 10 tons of asphaltic materials. For complete details see your Blaw-Knox Distributor.

BLAW-KNOX

Rubber-tired mounting of the Blaw-Knox PF-190 has allowed it to lay up to 270 tons per hour.

BLAW-KNOX COMPANY
Mattoon, Illinois

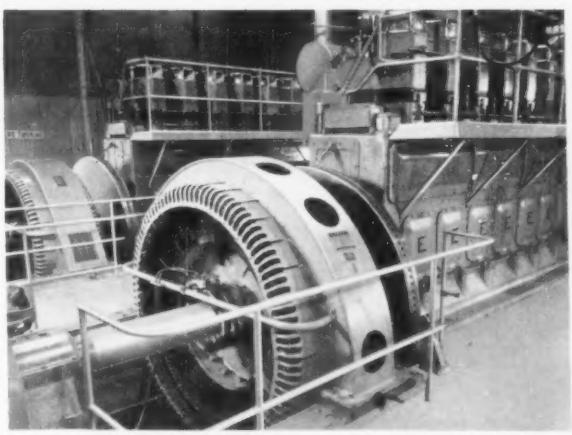
CONSTRUCTION EQUIPMENT DIVISION

• REPORT FROM JUNEAU, CAPITAL CITY OF ALASKA

Alaska City Relies on Enterprise Engines for Dependable, Versatile, Low-Cost Power

As with any community, the health and welfare of Juneau would be badly impaired if there were a prolonged interruption in electric power. That's why two modern Enterprise Diesel-electric generator sets have been installed to support the hydro-electric output in winter, and peak load periods during the summer months. With electrical demands nearly tripled since the first Enterprise Engine was installed in 1951, the second unit was ordered and placed in service early last year. This is a "twin" to the first DSQ-318 Enterprise, which had built a reputation for such excellent operation at low cost per KW of capacity.

Whether your community's need is for standby, partial load or complete utility service, Enterprise will serve you well. Get full information on Enterprise diesel, dual-fuel, tri-fuel and spark-ignited gas engine models from 73 to 7703 HP. Engines may be equipped to burn lower cost "heavy" or residual fuels if desired. Write today, or call your nearest Enterprise office for complete information.



Two 1700 HP Enterprise Engines at this Alaska Electric Light and Power Co. plant provide economical power for sharing the base electric load with hydro units, and for peaking. Each generator set delivers 1200 KW at only 360 RPM.

Over a million horsepower at work the world over!

ENTERPRISE
dependable ENGINES

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California
Export Department, New York

Boston • Chicago • Denver • Des Moines • Fort Worth • Huntington • Jacksonville • Kansas City • Los Angeles
Minneapolis • New Orleans • New York • Pittsburgh • San Diego • Seattle • St. Louis • Tulsa • Washington, D.C.

It's a fact . . . our handy Readers' Service card is the way to get new catalogs.

NEW!
for the FORDSON MAJOR DIESEL

New Ford F.M.D. Industrial Loader has "step-on" design, gives you ½ cu. yd. bucket capacity . . . double-action lift cylinders for down crowd . . . 2000 lbs. maximum load capacity at full lift . . . over two tons of break-away lift capacity . . . 11'10" maximum lift, 32" bucket reach. Bucket tilt back holds full capacity loads, and parallel linkage of lift arms keeps bucket approximately level at any lift height. See this high production, fuel-thrifty team in action on your own job!

Now's the time to mail this month's Readers' Service Card.

LOAD A YARD A MINUTE!

NEW FORD step-on INDUSTRIAL LOADERS

for Ford Tractors

Job-proved on applications like your own! Ford's new "Step-on" Industrial Loaders are *all new*, yet they've been field-tested throughout the country by users like yourself, on jobs like your own. You can specify new Ford Industrial Loaders with confidence.

Ample capacity for a wide range of jobs! Ford's new "Step-on" Industrial Loaders are rated at 1000 pounds load capacity at dumping height. They give you over a ton of break-away lift capacity for work in hard or frozen ground.

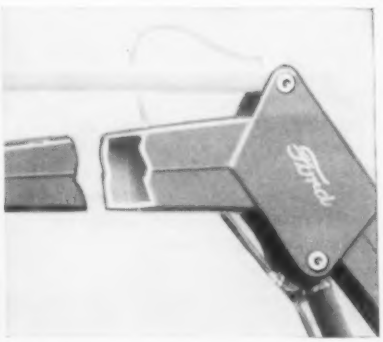
A selection of job-fitting attachments! You can turn Ford Tractor power into more profit with a quick-attaching ⅓ cu. yd. material bucket, ⅝ cu. yd. light material bucket and fork. Dozer blade and crane to be available soon. There's also a choice of single- or double-acting lift cylinders to fit your individual job requirements.

Compare them with any loaders in their class! Check ease of handling . . . better weight distribution means easier steering with Ford. Check ease of operation . . . Ford Loader controls are mounted close at hand for faster, easier operation. Check operator safety . . . Ford bucket design reduces danger of falling material. Check all these advantages and more by contacting your nearby Ford Tractor and Equipment Dealer. Call him now, or write to:

TRACTOR AND IMPLEMENT DIVISION
FORD MOTOR COMPANY
Birmingham, Michigan

CONVENIENT "STEP-ON" DESIGN—Easier than getting into your own car! Open design and wide, low step plates save operator time and effort. A real convenience and safety feature.

HIGH LIFT AND LONG REACH speed loading of high-bodied trucks. Lift is 10′10″ from ground to bucket bottom. Reach is 26″ from tractor bumper to bucket lip at full height.



RUGGED BOX FRAME CONSTRUCTION Built to stand up under the abuse of shock loading from stockpiles. Dependable service. Less dead weight . . . more payload per pound of loader.

Get full details of this month's products . . . mail your Readers' Service card today.

Municipal Water Filter Installation cost can be cut 1/2 to 1/3 with...

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL SCJ because:—

1. The original cost of a diatomite plant for public supply is ½ to ⅓ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces the chlorine demand of the water by removing organic matter to an exceptionally high degree. The overall bacteria reduction in the effluent is from 80% to 90%. Sterilization of the finished water can be accomplished with much less chlorine. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.

Less than 0.2% of water is required to sluice and clean the Model SCJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

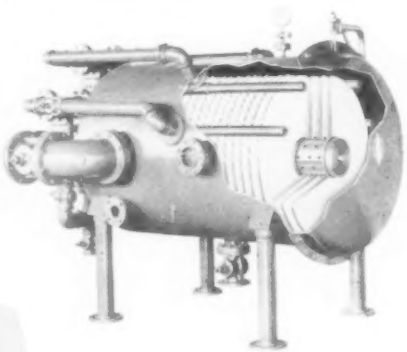
Operators can be easily trained to handle this filter, no highly skilled specialized personnel is required to insure efficient performance.

Sparkler Model SCJ filters can supply practically any required volume of city water. Single units with a capacity of 5,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

Interior construction of Model SCJ Water Filter. Sparkler filtration engineers have introduced, in the SCJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced innovations in recent years.



SPARKLER FILTERS

SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

Thousands use our Readers' Service card to keep up to date . . . do you?

Help in Selecting Motor Graders

145. A 16-page catalog, No. 380, released by The Galion Iron Works & Mfg. Company, Galion, Ohio, describes the numerous construction and operating features of the Galion Model 503 Motor Grader. Optional equipment includes hydraulic shiftable mold-board, front-end scarifier, "V" and straight snow plows, rear-end bucket loader and bull-dozer. Check reply card for full data.

Valuable Bulletin on the "Quick-Way" Shovel

150. Complete information on the "Quick-Way" shovel is available in bulletin from "Quick-Way Truck Shovel Co., P.O. Box 1800 Denver, Colo. Described in detail are the anti-friction bearings, hook rollers, central lubrication system and the ease of operation, quietness and safety. Specific basic machine engineering data and ratings are also included. For your copy check the reply card.

Cut Road Building Costs With A Tamping-Leveling-Finisher

175. For a full description of roadbuilding methods with a tamping-leveling-finisher which lays a smooth mat without forms, tamping and compacting to desired grade, get Bulletin 879-A from Barber-Greene Co., Aurora, Ill. Check the reply card today.

Getting Specified Density In Granular Bases and Fills

188. Vibratory compactors offer the means for getting specified density in rock, slag, soil-bound macadam, gravel and sand base courses. Just one pass may suffice. Get complete information from Jackson Vibrators, Inc., Ludington, Mich. See how adaptable compactor units handle a variety of compaction needs. Check the reply card today.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass., or check the reply card for your copy.

How the Mobil-Sweeper Can Improve Street Sweeping

305. Sweeping costs can be cut with the Mobil-Sweeper which features safe highway speeds up to 55 mph, carries 2 2/3 cu. yd. dirt hopper, sweeps swath up to 10' wide with full floating brooms. Hills and deep gutters are no obstacle. Write to the Conveyor Co., 3260 E. Slauson Ave., Los Angeles 58, Calif. or use reply card for complete details on this machine.

Trencher Fits Municipal Needs

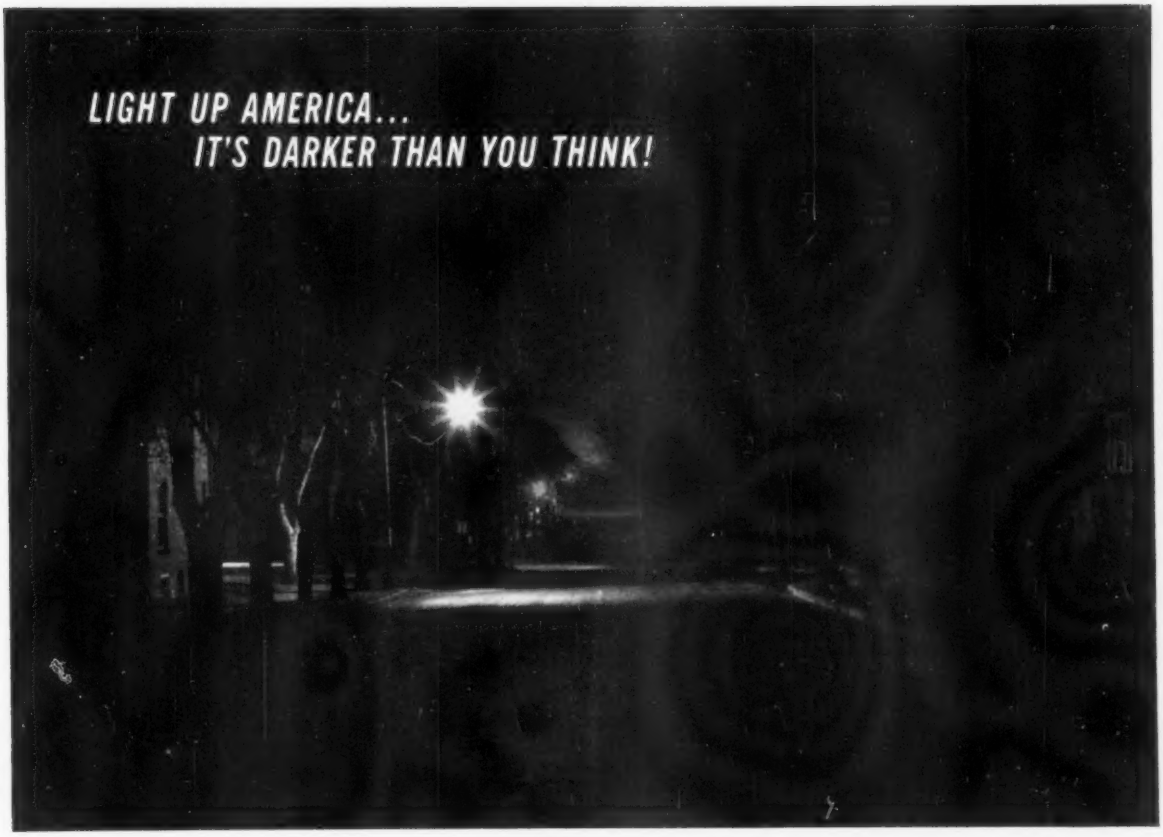
315. A bulletin describing the Cleveland Model 95 trencher has been published by the Cleveland Trencher Co., Cleveland 17, Ohio. The Model 95, called "The standard machine for city and suburban work", is versatile, maneuverable and economical for use on water lines, service lines, road widening and all utilities trenching. Get this 8-page illustrated bulletin by checking the reply card.

Economical Scraper Handles Many Heavy Jobs

398. Among the many applications of the versatile Model D Tournapull are: grading and building roads; handling garbage disposal; and grading, leveling and terracing. For details on how its speed, power and ability to work either as a self-loading tool can help your production and lower your costs, write Le Tourneau-Westinghouse Co., Peoria, Ill., or check the reply card.

Advanced Tractor Design Gives Better Performance

399. The Ford Tractor offers 4-wheel stability, built-in hydraulic system, power take-off, as well as greater power, performance and economy. A complete booklet describes five tractor models in two power series, showing the latest in advanced tractor design and including many applications of equipment for saving time and money. For your copy check the reply card or write Tractor and Implement Division, Ford Motor Co., Birmingham, Mich.



Someone will get credit for lighting this street. Who will it be?

Pretty soon something's bound to happen on a dark street like this, and when it does, someone will spearhead a drive for good public lighting. He'll get what he's after, too, because who casts a vote for darkness on his community's streets?

And when the lights come on, business picks up, accident rates drop, there's less crime. Streets *look* safe and prosperous—and they *are*.

The cost? Good street lighting is the least expensive capital improvement you could sponsor.

"Out of Darkness" a new, dramatic film story of how one community met its street-lighting problems, is now available to civic groups, community service organizations, etc. This 16-mm, sound, black-and-white movie runs 26 minutes. Borrow a print of "Out of Darkness" from your nearest G-E Apparatus Sales Office.

Section F455-10
Outdoor Lighting Department,
General Electric Company, Schenectady 5, N. Y.
Please send me a free copy of the 16-page bulletin, "Residential Street Lighting," GEA-6316.

Name _____
Street _____
City and State _____

Progress Is Our Most Important Product

GENERAL ELECTRIC

Need more facts about advertised products? Mail your Readers' Service card now.

What Should You Look For In a Power Sweeper?

206. Helpful information to aid you in the selection of a power sweeper to fit your needs is provided in Bulletin 85.2, issued by G. H. Tennant Co., 2530 N. Second St., Minneapolis 11, Minn. Full data on the highly maneuverable Tennant Model 75 Sweeper is included. Get your copy by checking the reply card.

The Modern Approach to the Brush Problem

222. Eliminate your brush disposal problem by using an Asplundh Chipper. For complete information on what the Chipper can do, how it can save on costs, various types available and other outstanding features write to Asplundh Chipper Co., 505 York Road, Jenkintown, Pa., or check the reply card.

For Prompt Service Use The Reply Card

Valuable Information On Aerial Surveys

437. What you should know about aerial surveys is described in detail in the latest literature just released by Alster and Associates, 6135 Kansas Ave., Northeast, Washington 11, D. C. Topographic maps, mosaics and planimetric maps by aerial photograph are fully illustrated. For more information check the reply card.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Machine Co, Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layout and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute, c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

How to Make Better Sewer Pipe Joints

37. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston Co., Dept. P.W., Adams, Mass. Check the reply card.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves. Check the reply card for this useful information.

All-Electric Floatless Liquid Level Control

174. Description of operating principles and application of B/W controls show the simplicity and many uses of these all-electric, floatless devices. Get latest bulletins for engineering data, diagrams of typical installations and details of component parts. Check the reply card or write B/W Controller Corp., Dept. PW, Birmingham, Mich.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included. Check the reply card for your copy of this helpful handbook.

Theory of Controlled Digestion With Floating Cover Tanks

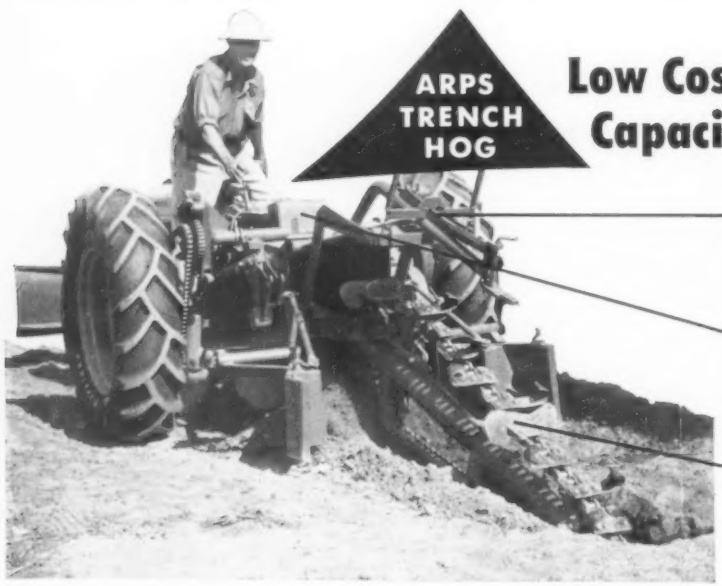
88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers. Requests for this valuable booklet to made on business letterhead.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled, permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card for free copy.

Non-Clogging Vertical Wet-Pit Pump Described

182. Full engineering data on Worthington "Freeflow" wet-pit pumps with non-clogging impellers capable of passing solids and stringy material are included in Bulletin W-317 B-12. Check these pumps for sump, sewage and drainage service. Bulletin available from Worthington Corp., Harrison, N. J. Just use the reply card.



ARPS TRENCH HOG

Low Cost, Big Trencher Capacity and Performance

- **STURDY, ALL-STEEL FRAME, ANTI-FRICTION BEARINGS** are among construction features job-proved by thousands of rigs in use.
- **ACCURATE HYDRAULIC DEPTH CONTROL and INDEPENDENT DRIVE WHEEL SPEED CONTROL** for precise straight line trenching and accurate curve digging.
- **TOUGH, 6" to 20" CUTTERS** dig up to 800' an hour — special cutters available for frozen and rocky soil.
- **THREE BOOM SIZES** available for depths of 3½', 5½' and 7'. Boom raises to almost 90° angle for convenient travel.

Wherever there's a trenching job to be done — for builders, plumbers, utilities, industries, municipalities, contractors, etc. — you'll find the ARPS Trench Hog gives big trencher performance at low unit cost. One-man transportation and operation help to bring expenses way below that of hand labor.

Further information, specifications and prices upon request — write today! **Dept. PW**

ARPS CORPORATION NEW HOLSTEIN, WIS.

TRENCHERS
HALF-TRACKS
BULLDOZERS
UTILITY BLADES

SECOND BEST!

Only when the perfect pipe is invented.

The dream pipe for which all engineers pray would be light as a feather, indestructible, pliable enough to bend around obstructions, and would be installed by a magical machine that digs the trench and extrudes, lays and backfills the pipe.

Needless to say, this will be in the far distant future. Until such a dream pipe is invented, water works officials and engineers are specifying the next best pipe—LOCK JOINT CONCRETE PRESSURE PIPE. It comes the closest to realizing their ideal specifications: long life at top carrying capacity because it never corrodes nor tuberculates; great strength to withstand internal pressure and exterior loading; versatility to meet the most difficult laying conditions, and minimum maintenance requirements over the years.

LOCK JOINT PIPE CO.

East Orange, New Jersey

Sales Offices: Chicago, Ill. • Columbia, S. C. • Denver, Col. • Detroit, Mich. • Hartford, Conn. • Kansas City, Mo.

Pressure • Water • Sewer • REINFORCED CONCRETE PIPE • Culvert • Subaqueous

Now's the time to mail this month's Readers' Service Card.

Locate Mains, Services and Leaks Without Digging

186. An 8-page booklet tells how to use the Fisher "M-Scope" to locate buried pipes, cables, valves, manhole covers, conductive and non-conductive sewer pipes and septic tanks by electronic means. Dry battery operated. Only one man is needed for operation. Get data from Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif., by checking the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy. Get yours by checking the reply card.

Information on An "All-Purpose" Municipal Paint

423. Whether the requirement be traffic paint, sewage plant, exterior finishes for masonry buildings, or interior protection for metal equipment send for literature just issued by Cellulose Products Dept., Hercules Powder Co., 978 Market St., Wilmington 99, Delaware, in Parlon. This chlorinated rubber paint shows good resistance against coal gas, chemicals and chemical fumes and salt water atmosphere. Check the reply card today.

Solids Pump Uses Recessed Impeller

428. The Wemco "Torque-Flow" solids pump works with a completely recessed impeller which creates a vortex effect and transmits power exactly as in a fluid type torque converter. This avoids flow through impeller vanes and reduces clogging difficulties when handling sewage sludge or abrasive materials. For full details get Bulletin SP-10 by writing to Western Machinery Co., 760 Folsom St., San Francisco, Calif., or check the reply card.

Complete Information and Installation Data on Clay Pipe

225. A fully illustrated bulletin containing complete data on vitrified clay pipe with pre-assembled Tylox flexible couplings has just been released by Universal Sewer Pipe Corporation, 1500 Union Commerce Building, Cleveland 14, Ohio. Complete information on Universal's rubber, neoprene and polyvinyl chloride resin types of Tylox couplings is included. Check the reply card today.

Expansion-Contraction Joints, Sealing Compounds and Waterstops

272. Helpful data to aid in the selection of premolded highway joint fillers and joint sealing compounds, rubber waterstops for concrete construction in water and sewage plants, sewer joint sealers and many related materials are provided in latest literature of Servicised Products Co., 6051 West 65th St., Chicago 38, Ill. Get full details by using the reply card.

Helpful Bulletins Give Sludge Pump Details

318. "Scru-Peller" sludge pumps for handling thick primary sludge, cutting up all solids as they pass through the pump, described with illustrations of details in a 20-page Bulletin 190B. Standard non-clog pumps are described in Bulletins 126E and 127D. Get them from Chicago Pump Co., Dept. J, 622 Diversey Pkwy., Chicago 14, Ill., by checking the reply card.

Modern Methods and Materials For Jointing Sewer Pipe

402. In a compilation of reprints and related supplementary material, the Atlas Mineral Products Co., Mertztown, Pa., presents a comprehensive review of all types of sewer jointing materials and methods. You will find this interesting and informative reading. Get a copy by checking the reply card.

Combat Unpleasant Odors At Municipal Sanitation Sites

404. Malodors at municipal refuse disposal sites, waste treatment plants and incinerators may be effectively "neutralized" by the odor masking products of Rhodia, Inc. Be sure to investigate this means of eliminating complaints from unpleasant odors. Write Rhodia, Inc., 230 Park Ave., New York 17, N. Y. or check the reply card.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 102 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Literature on H-Type Construction For Incinerators

434. This new H-construction developed especially for incinerator use features flexibility of design, lower costs through standardization, ease in speed of assembly and other advantages which are fully covered in literature from LacledeChristy Co. Div., H. K. Porter Co., Inc., 2000 Hampton Ave., St., Louis 10, Mo. Check the reply card.

Friction Loss of Head Chart and Flow Powergraph

450. A convenient means of determining friction loss of head and power required to compensate for it. Combines a 2-page loss of head chart with a 1-page powergraph. Data derived from the William and Hazen Formula. Available from Johns-Manville, 22 East 40th St., New York 16, N. Y., or by checking the reply card.

Applications of Welded Steel Pipe

456. A bulletin that describes and illustrates the advantages of welded steel pipe for piping, water supply, sewage disposal and foundation piling is available from Armco Drainage & Metal Products, Inc., Middletown, Ohio. Eleven advantages are listed and dimensional data and properties are given along with data on pressure design. Check the reply card for WSP-11055.

FILTER SAND AND GRAVEL

Produced from an inland pit hence free from river contamination and foreign matter.

Shipment in bulk or bagged.

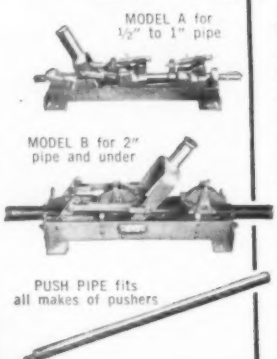
Many of the larger filter plants throughout the United States are equipped with our products.

PROMPT SHIPMENT

Inquiries and orders solicited.

NORTHERN GRAVEL COMPANY
Muscatine, Iowa
P.O. Box 307 Amherst 3-2711

Trojan Pipe Puller & Pusher
installs or renews pipe under pavement
in half the time required by any other machine!



Exclusive continuous action, which eliminates all resetting of grip, does the trick!

The Trojan combines pushing and pulling operations in one machine —keeps pipe continuously moving —lets you install 40' services in as little as 20 min.

Model A needs only 5' trench. One man can easily install the average service. 15 tons of pushing pressure possible.

Model B is reversible in 30 seconds—has 3 speeds for different soils. New dog with individual inserts cuts maintenance.

Write today for full details!

The TROJAN Manufacturing Co.
1114 Race Drive · Troy, Ohio

ESSICK

VIBRATING ROLLERS

SOLVE

COMPACTION PROBLEMS

RIGID SPECS is yours COST

Now you can do "the impossible"! Those engineered compaction specifications that can't be met with ordinary compactors are a soft touch for the dynamic, new Essick vibrating rollers. We'll let the facts speak for themselves. The Essick vibrating rollers have consistently achieved compactions in excess of 95% of AASHO modified tests—often, where other compactors **could not even operate.**

Don't let compaction problems kick the profits out of your job! The revolutionary Essick vibrating rollers are designed to **earn** those **extra dollars** by eliminating the need for much costly heavy equipment. They're built to reduce the time and effort required to do the kind of superior compaction job required by today's soil engineers.

IT WILL PAY YOU TO INVESTIGATE ESSICK VIBRATING ROLLERS

VR-28-W

A self-propelled machine containing a single, 28" wide roll, with two speeds forward and reverse; with an independently controlled, high frequency vibrating unit within the roll.

VR-32-R

A lightweight, tandem roller with two 32" wide rolls, two speeds forward and reverse; containing a high frequency vibrating unit within the compaction roll.

VR-54-T

A trailer type roller containing a single 54" wide roll; with independent, clutch controlled, high frequency vibrating unit within the roll.

ESSICK

MANUFACTURING COMPANY

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LOS ANGELES, CALIF.

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ELIZABETH, NEW JERSEY

Affiliated with **THE T. L. SMITH COMPANY,** Milwaukee, Wisc.

The Essick Manufacturing Company has prepared complete, free descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller. This is available to you by mailing attached coupon.

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Attention of _____

Thousands use our Readers' Service card to keep up to date . . . do you?

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy coupon. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn. Use the reply card.

For Prompt Service Use The Reply Card

Safe-T-Cones Solve Traffic Problems Night and Day

136. For data on Safe-T-Cones, the all-rubber traffic guides available in two sizes, 18" and 28"—painted or reflectorized for day and nightime use—get bulletin from Radiator Specialty Co., Charlotte, N. C. Information included on Safe-T-Signs which add greatly to value of markers. Check the reply card.

Bringing Modern Street Lighting to Your Community

141. A 22-page catalog entitled "Light the Way for a Better Community" has just been issued by General Electric Co., Schenectady, N. Y. This catalog suggests how greatly your community will benefit from relighting and demonstrates the importance of a lighting survey and a carefully engineered planned-lighting proposal. For full details check the reply card.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

REFUSE COLLECTION AND DISPOSAL

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a solution, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

Thinking of Sanitary Landfills? Get This Booklet Now

131. One of the most informative descriptions of the sanitary landfill method of garbage and refuse disposal is presented in Caterpillar's 16-page booklet "The Story of Mid-City and its Sanitary Landfill." The booklet is designed to serve as a guide to proper site selections, the choice of the right equipment to do the job, and the actual operations of sanitary fill. Pictorial treatment shows how and when to start such a program, what to look for in a site, benefits received by the community, and other important considerations. Published by the Caterpillar Tractor Co., Peoria 8, Ill. Check the reply card for your copy of Form 30909.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check the reply card today for catalog No. 1702 from Flynn and Emrich Co., Holliday and Saratoga Sts., Baltimore 2, Md.

New M-B Packer Body Designed for Maximum Payload

309. The M-B Packer Body, designed to provide maximum payload on a minimum size, low-cost truck, features effective, simple compaction system; provides easy loading, positive discharge, all safety features. Available in 12-14-16 yd. capacities. Get all the facts from M-B Corporation, New Holstein, Wis. by checking the reply card.

Check These Features On Refuse Collection Bodies

383. The Heil "Colectomatic" refuse collection unit incorporates the best features suggested by municipal operating crews, supervisors and private operators to provide easy loading, simple operating mechanism, bulldozer type packing, fast dumping and many other important advantages. Available in 16 and 20 cu. yd. capacities. Check them all by getting attractive Bulletin BH-54103 from The Heil Co., 3044 W. Montana St., Milwaukee 1, Wis. Your copy is ready—just check the reply card.

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Rubber PIPE GASKETS

PROJECT: Villard Avenue sanitary sewers, for Bureau of Sewers, Department of Public Works, Milwaukee, Wisconsin.

ENGINEERS: Lloyd D. Knapp, City Engineer; Edmund Hirsch, Engineer in charge of Sewer Construction Division; Ted Prawdzik, Chief Design Engineer; and Walter Schmitz, Construction Engineer.

PIPE: 21" and 24" reinforced concrete pipe, furnished by Waukesha Cement Tile Co., Waukesha, Wisconsin.

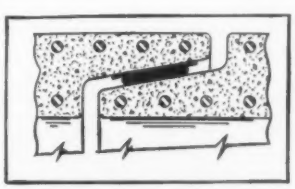
CONTRACTOR: W. J. Lazynski, Inc., Milwaukee, Wis.

"LEAKPROOF JOINTS" Was What Engineers and Officials Demanded For The City's New Villard Ave. Sewers. They Got Them—With a Tylox Rubber Joint Specification.

With public funds at stake, even the world-wide TYLOX reputation for *no joint-leaks* did not satisfy these officials. The line ran through wet soil areas which invited infiltration troubles. They had to *make sure,* and to get the proof, tests were ordered on flooded sections of completed line.

When we asked the engineers for results of the tests, we were not surprised at the answer . . . "Virtually *no* infiltration . . . We didn't even make a measurement."

Couple the certainty of "no infiltration" with the other advantages of TYLOX Joints — corrosion resistance . . . quick installation . . . flexibility — and you have the ONE pipe joint that meets requirements of taxpayer, designer and builder alike. Write us today for complete TYLOX information and more case histories. Read the facts, and on your next pipe project "make sure" of no joint leaks with a TYLOX specification.



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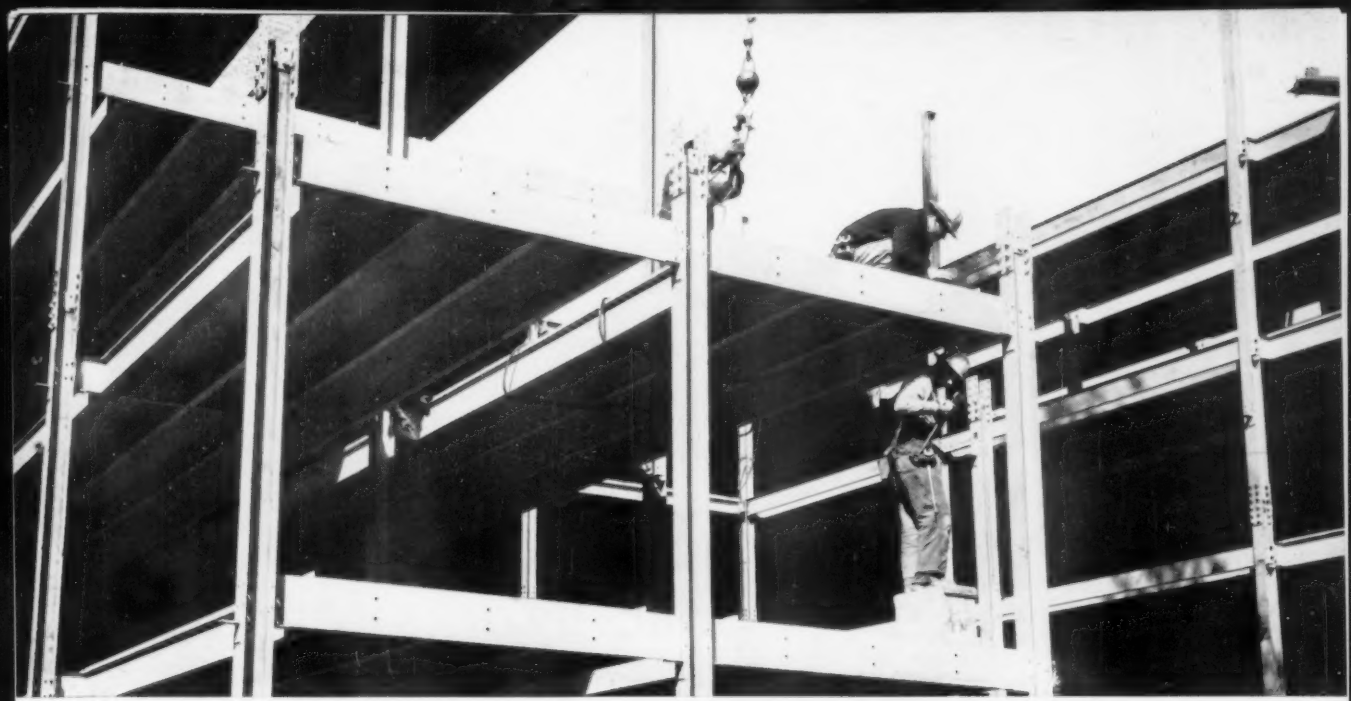
"Economy Package"

Structural Steel framework during erection. The 500 tons of Structural Steel were fabricated by the Missouri Valley Steel Company, Sioux City, Iowa.



Connections were made between all structural members by means of bolts—one of the fastest and quietest methods of erection.

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This unique, four-deck city parking garage in Sioux City, Iowa, comes as close to being a prefabricated building as is possible without actually being one. The 500-ton Structural Steel framework was erected and bolted in jig time. 223 tons of USS Multigrip steel floor plate were laid. Wiring and a minimum of brickwork were accomplished, and the job was done. Total erection time—8 weeks.

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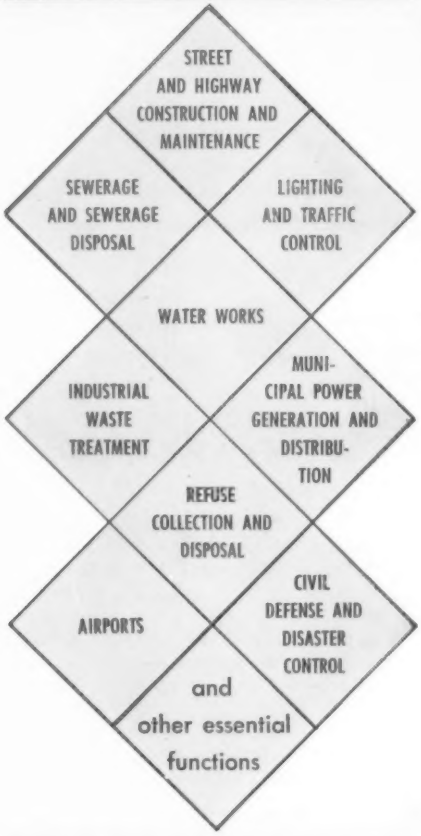

includes expanding needs for WATER WORKS to meet the growth in population, expansion of industries and shifts to the suburbs. It is estimated that the demand for increased water facilities alone will call for nearly $300 millions in each of the next ten years.

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The WATER WORKS MANUAL and Catalog File—new 1956 edition ready for the A.W.W.A. meeting also—open until March 1 for space reservations; March 20 for plates.

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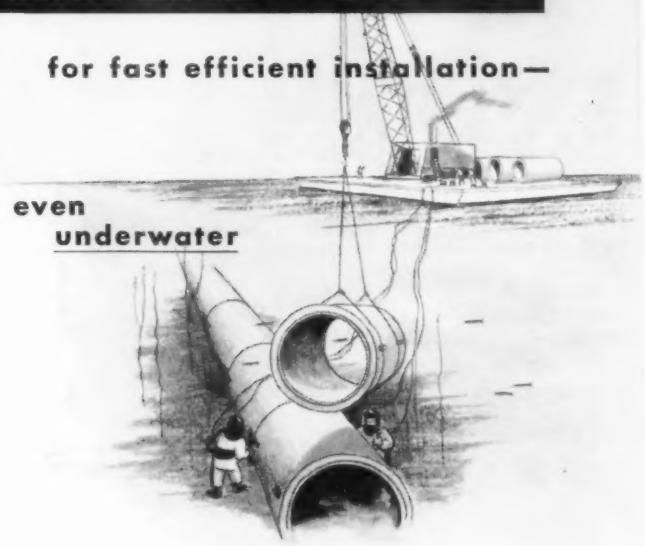

Whether underwater or not, long lengths speed installation by reducing handling and joint-making and results in lower initial costs. The reduced number of joints and the improved flow capacity also mean savings in operation and maintenance.

The "pressure proven" rubber and steel AMSEAL joint provides a flexible but positive water-tight seal against costly infiltration or leakage. For underwater work, subaqueous connections are provided to simplify installation.

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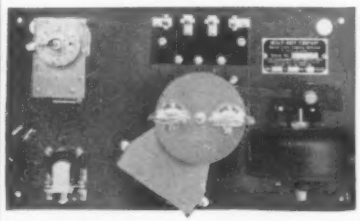
RS-3



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Adjustable VALVE BOXES

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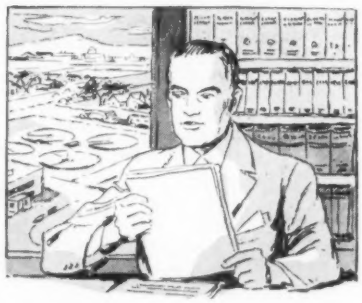

MELVIN NORD,
Dr. Eng. Sci., LL. B.
Registered Professional Engineer

Down the Drain

The case of *Johnson v. City of Winston-Salem et al*, 239 N.C. 697, 81 S.E. (2d) 153; 44 A.L.R. (2d) 949, (a North Carolina Case decided March 24, 1954), involved the question of whether or not a municipality was liable for failure to maintain a drainage conduit on privately-owned land, where extensive improvements by the city had materially increased the flow of surface waters into catch basins leading to the conduit.

Harper and Johnson occupied adjoining plots of land on a downslope across which surface waters ran. Harper was at an intermediate position, receiving surface waters from other owners higher up, and discharging it to Johnson. The upper owners had previously installed a 24" drain pipe in the natural drainage channel, filled in the channel and developed the property for residential purposes.

Around 1920, Harper's predecessor in title Thomas, installed a 24" drainage pipe in his natural drainage channel, connected it with the upper drainage pipe, and filled in his ditch. His property included that which is now occupied by both Harper and Johnson, and the pipe continued down to a point below Johnson's present house. In 1928, the City made extensive improvements in the upper part of the neighborhood, thereby materially increasing the flow of street surface waters into the catch basins feeding the underground drain pipe mentioned above.

Later, Harper bought Thomas' land, with knowledge of the underground drain. He sold the lower portion to his son, who leased it to Johnson. There was a manhole on the Johnson property within 10 feet of his house. The manhole was about 20 feet deep and 2 feet across.

Some weeks prior to June 27, 1949, a hole started developing over the underground drain on Harper's property. The hole was triangular in shape, with 20 foot sides, and was from 20 to 25 feet deep. Harper erected a fence around the hole. A cedar tree was beginning to fall down into the hole.

On the evening of June 27, 1949, there was a heavy rain for about four hours. During the rain, the manhole close to Johnson's property overflowed because it had become stopped up by a large obstruction which washed down the pipe into the manhole and wedged against the outfall side of the manhole. This caused the water to gush out of the manhole in great volume and force. It forced the lid off the manhole and rose several feet into the air like a geyser, and continued this way for over an hour. Great volumes of water and debris poured into Johnson's basement through two ground-level windows in his house. The basement filled completely up with water in less than an hour to a depth of 65 inches, doing considerable damage to his personal property stored in the basement.

Johnson brought suit against Harper and the City. The principal issue was whether the responsibility of maintaining the underground drain was on the City instead of on Harper, in view of the fact that it connected into the City drainage system.

The court held that this did not cause the City to be liable, as it did not show legal appropriation or control of the entire conduit by the City. The fact that Harper's predecessor in title, Thomas, had built a 24" drain, the same size as that used by the upper landowners, indicated assent by the owners of the conduit to use it up to its capacity. There was no evidence that the City augmented the flow beyond this. Harper therefore had the duty to maintain drainage pipe on his property.

As to whether or not Harper had been negligent in maintaining the pipe, it was held that this question

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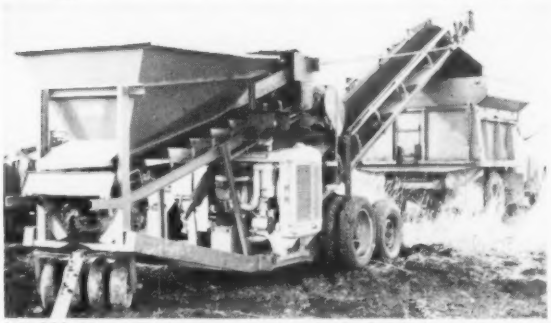
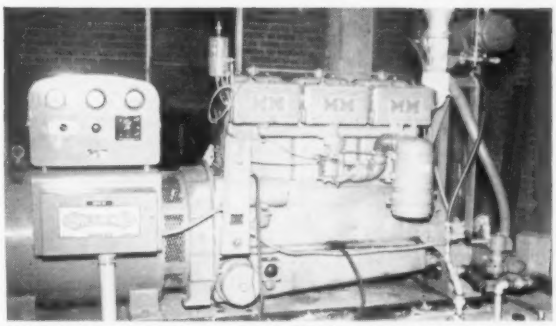


MM 283-4A gasoline engine powering a Lindig Soil Shredder. Compact, easily installed MM engines provide a permanent, integral power source for a wide range of portable equipment.



MM 800-6A natural gas engine drives a 75 KW direct-connected generator. Equipped with automatic remote control, this unattended stationary plant supplies regular or standby power.

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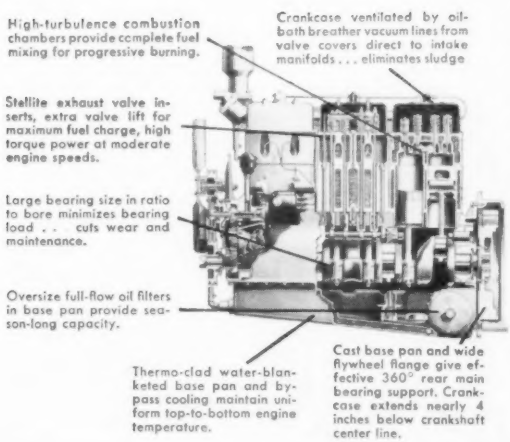
MM 403-4A gasoline engine mounted on a Warner-Swasey Gradall. Choice of gasoline, diesel, LP gas, natural gas or distillate fuel equipment offers continuous-duty MM power at lowest fuel costs.

Here's how MM MINNEAPOLIS-MOLINE MODERN MACHINERY *builds* Honest HP


High-turbulence combustion chambers provide complete fuel mixing for progressive burning.
Crankcase ventilated by oil-bath breather vacuum lines from valve covers direct to intake manifolds . . . eliminates sludge
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4 Cylinder Carbureted Models*		6 Cylinder Carbureted Models	
MODEL 206A-4A	3⅜" x 5"	MODEL 425-6A	4¼" x 5"
MODEL 283-4A	4¼" x 5"	MODEL 605-6A	4⅜" x 6"
MODEL 403-4A	4⅜" x 6"	MODEL 800-6A	5¾" x 6"

*Engineered for gasoline, distillate, natural or LP gas.

4 Cylinder Diesel Models		6 Cylinder Diesel Models	
MODEL D-283-4A	4¼" x 5"	MODEL D-425-6A	4¼" x 5"
		MODEL D-605-6A	4⅜" x 6"

Honest horsepower is horsepower developed at operating speeds that are practical for heavy continuous duty. That is why Minneapolis-Moline engines are designed to develop maximum torque at around 1000 rpm and are power rated at from 1200 to 1400 rpm. Deep-pocket, high-turbulence combustion chambers for progressive fuel burning and prolonged pressure combined with large displacement and high compression ratios enable MM engines to deliver work-type power at usable speeds. Where special installations require higher rpm with rapid acceleration, MM engines can be furnished with aluminum pistons.

MM engines are stocked in various fuel models and standard equipment bundles for quick delivery. You can buy bare engines, engines with radiator, fan and power take-off, or complete enclosed units. Modification of standard units on separate production runs to meet special requirements are part of the flexible MM operation that saves you time and money.

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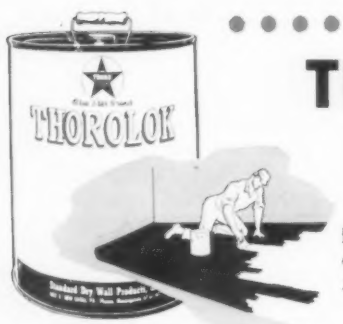

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should have been submitted to a jury, and a new trial on this point was therefore ordered.

Limited Access Highways

One of the problems involved in the building of freeways, or limited access highways, is that abutting landowners may be deprived of their "right of access" to the highway. If this happens, they are entitled to compensation.

In *Schnider v. State of California*, 38 Cal. (2d) 439; 241 Pac. (2d) 1, a California case decided Feb. 1, 1952, the question of compensation for denying "direct" and "indirect" access to the freeway was in issue.

Schnider owned two lots which were each one lot removed from Olympic Blvd. One lot was on Fourteenth Street, and one on Euclid Street, a block away. Neither lot had direct access to Olympic Blvd., but each had indirect access to it by the above-named streets. When the State decided to convert Olympic Blvd. into a limited access highway, it purchased the corner lots next to those of Schnider, in order to widen the highway, and placed a fence along the common boundary with Schnider's lots. No compensation was paid Schnider.

Schnider thereupon brought suit, asking compensation for his loss of access to the highway. It was held that he was entitled to compensation for the loss of his "indirect access" through the above-mentioned streets. However, it was held he was not entitled to compensation for loss of direct access to the highway across the fenced in boundary, since he never had any direct access previously.

In other similar cases, collected in 43 A.L.R. (2d) 1068, it has been held that where there actually was a previously existing right of direct access to a highway, compensation must be paid if it is taken away. And it has also been held that where there never was any highway at all before the construction of the freeway, there is no right to compensation for loss of direct or indirect access to it.

• • •

Purdue Industrial Waste Conference

The 11th Purdue Industrial Waste Conference will be held on May 15, 16, and 17, 1956 at the Purdue Memorial Union. There will be approximately 50 papers presented on subjects dealing with industrial wastes and their treatment. For full details write Don Bloodgood, Professor of Sanitary Engineering, Purdue University, Lafayette, Indiana.

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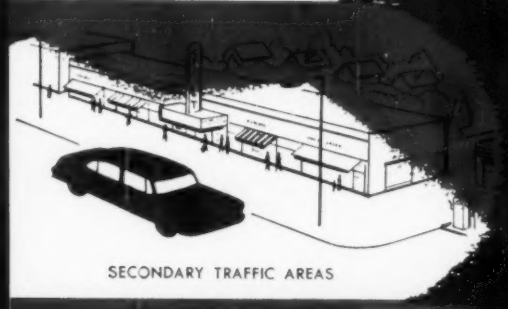
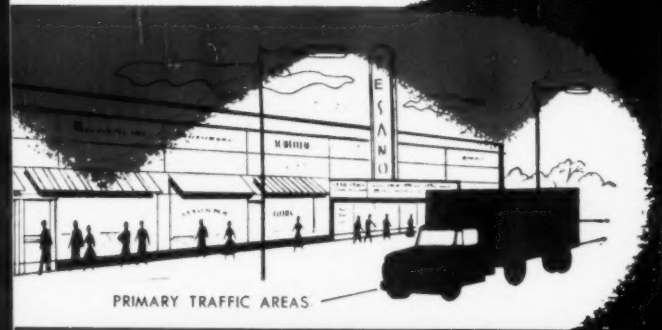
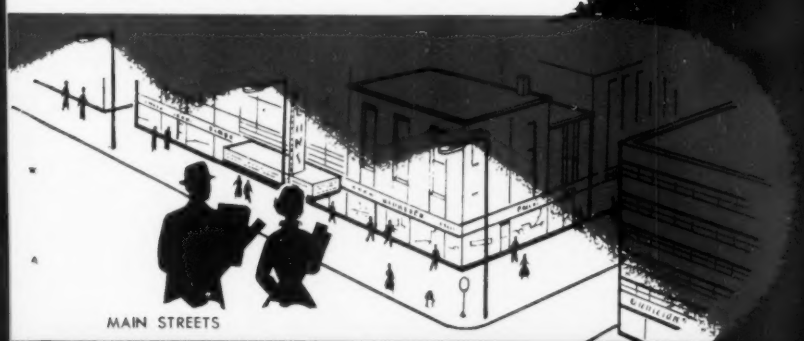


SECONDARY TRAFFIC AREAS

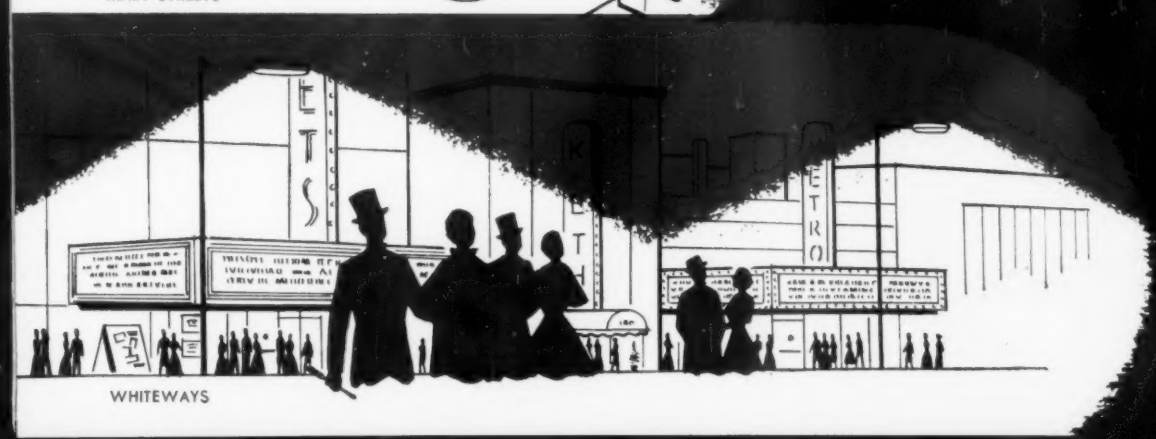


PRIMARY TRAFFIC AREAS

GENERAL ELECTRIC



MAIN STREETS



WHITEWAYS

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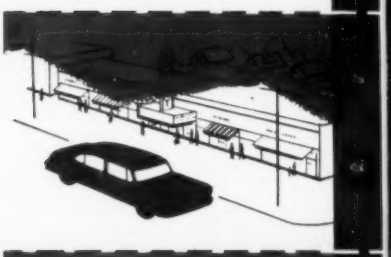
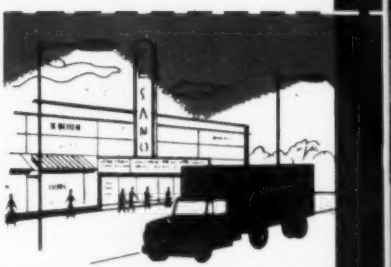
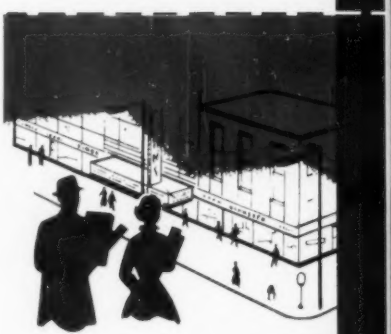
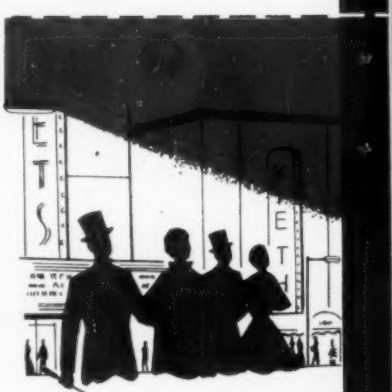








Six years ago General Electric introduced the first fluorescent luminaires in this country and started an ever-increasing trend toward this type of street lighting.

Now General Electric introduces another first—Fluorescent's First Family, in sizes from 2,700 lumens to 64,000 lumens.

Up to the present, whiteways and main streets have accounted for most fluorescent use—because luminaires were only designed in one size. Now General Electric presents a complete new line of these luminaires in 5 different sizes. Now it is possible to work out a complete and efficient relighting program to fill **all** the street lighting needs of an entire community. This program was made possible by the co-ordinated engineering development of new luminaires, ballasts and lamps for outdoor lighting, thus assuring reliable and consistent operation in all kinds of weather. Consequently, in addition to whiteways and main streets, all these many advantages of fluorescent luminaires can now be brought to residential areas and traffic arteries, too.

BETTER VISIBILITY—it is generally conceded that you see better on a fluorescent-lighted street than on one illuminated to the same level by mercury or filament luminaires. This means greater safety, fewer accidents.

MORE COMFORTABLE SEEING—The soft diffused light of fluorescents provides more comfortable seeing because:

(1) **Lower luminaire brightness means less glare and interference with visibility.**

(2) **Broader areas of pavement brightness provide better "seeability."**

(3) **The "cool-white" light of fluorescents does not distort color.**

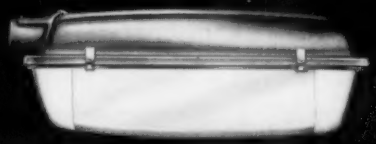
MODERN APPEARANCE—Distinctive lines, up-to-date design, plus the functional beauty of these new luminaires make them an asset to any street's appearance, and increase civic pride in the community.

LOWER MAINTENANCE—Operating experience indicates that the average effective life of fluorescent lamps in street lighting service is more than two years. In addition, neither the shatterproof, plastic globe nor the light output is unduly affected by extreme weather.

ECONOMICAL—Fluorescent's lower maintenance, easier installation, weatherproof engineering all add up to economy plus practicality . . . more value per dollar invested.

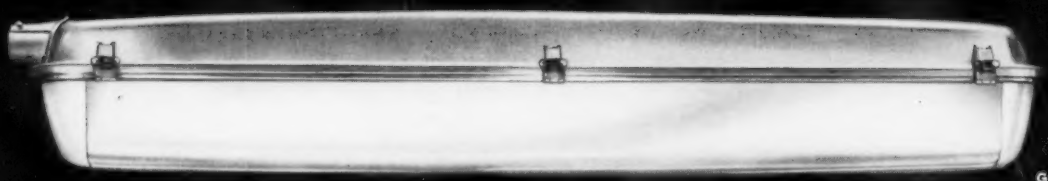
GENERAL ELECTRIC

FLUORESCENT'S FIRST FAMILY

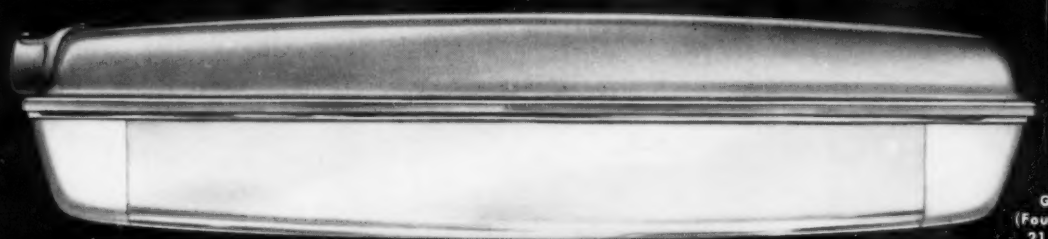


G-E Form 2025
(Two two-foot lamps)
2700 lumens for
Residential Areas

G-E Form 2045
(Two four-foot lamps)
6600 lumens for
Secondary Traffic Areas



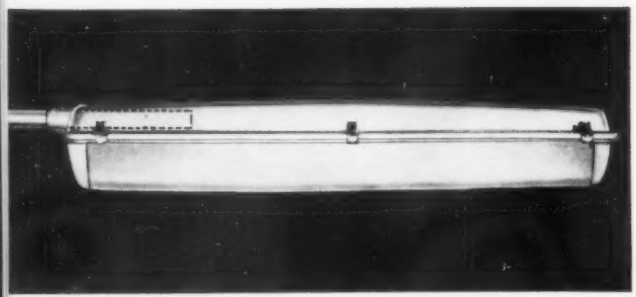
G-E Form 2065
(Two six-foot lamps)
10,600 lumens for
Primary Traffic Areas



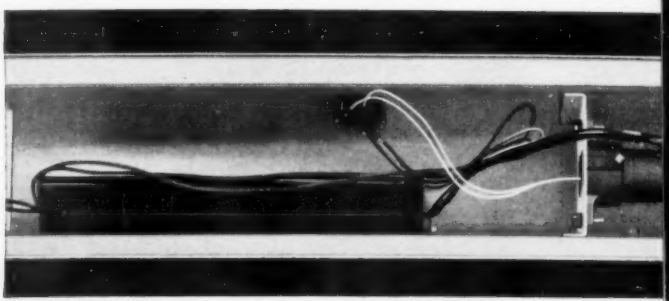
G-E Form 4065
(Four six-foot lamps)
21,200 lumens for
Main Streets

G-E Form 12065
(Twelve six-foot lamps)
64,000 lumens for
Whiteways

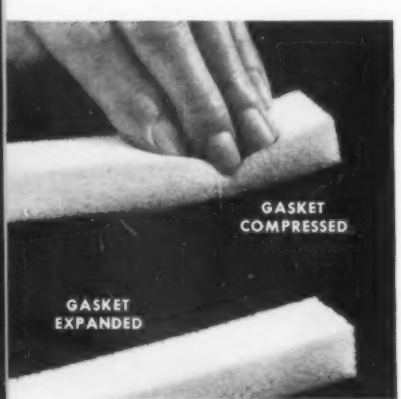
Only Fluorescent's First Family has all these features to simplify installation, lower maintenance, give maximum performance



SLIPFITTER MOUNTING . . . pipe bracket slides easily into luminaire, giving perfect support and eliminating the heavy, cumbersome clamp brackets which concentrated all stresses on the house-side end of the luminaire. A simple, self-contained, two-bolt leveling adjustment permits fast, easy leveling. The slipfitter design also gives wide latitude in mounting placement.

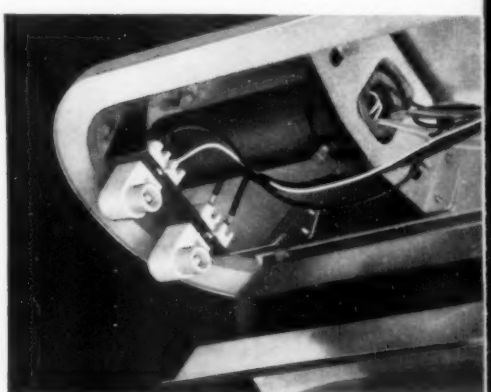


PRE-WIRED TERMINAL BOARD, INTEGRAL BALLASTS . . . located right near the slipfitter entrance, the terminal board makes wiring quick and simple. Since all secondary leads are already in place, only two primary leads have to be connected. In addition, ballasts are mounted inside the luminaires and come pre-wired to the terminal board and the lamp sockets.



WEATHERPROOF ENGINEERING . . . a new resilient gasketing material is used between the hood and the globe, assuring a uniform, positive seal against all elements all the way around. The one-piece plastic globe retains its clear appearance in all weather, be it fair or foul.

ONE-PIECE, SIDE-HINGED GLOBE AND HINGED REFLECTOR . . . plastic and light, this globe opens on hinges from either side of luminaire for safe, easy maintenance. No more worrisome, multi-piece, fabricated construction! Aluminum reflector is for easy access to terminal board, ballast and leveling adjustment.



SPRING-LOADED SOCKETS—NEW BASES . . . new type spring-loaded sockets provide a simple and secure means of installing the new, recessed, double-contact-base lamps. No more jiggling is necessary to line up lamp pins with socket—lamps can be installed or removed with one hand. Here's relamping at its easiest and safest!

Seeing is believing

There is probably Fluorescent street lighting near you—your local G-E representative should be able to tell you where. Go see for yourself how vastly superior this type of street lighting is to all other forms of illumination. Complete information on "Fluorescent's First Family" is available at your nearest G-E Apparatus Sales Office.

Or write Section 452-166, General Electric Company, Schenectady 5, New York.

"Out of Darkness," a dramatic 16-mm sound film on how one community met and solved its street lighting problems, is available from your nearest General Electric Apparatus Sales Office.

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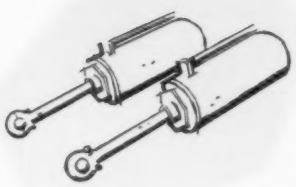
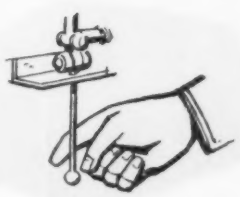
GENERAL ELECTRIC

Collects refuse . . . not trouble

HEIL Colectomatic provides More working time with Fewer working parts, Less maintenance



SIMPLY DESIGNED. Here's simplicity itself. Two hydraulic cylinders handle the entire loading and packing operation, automatically. The Heil Colectomatic has no chains . . . no hydraulic motors . . . no flexible oil lines from body to tailgate . . . no body retainer plates. Heil design eliminates these trouble-making wear points and reduces maintenance costs . . . gives more time on the job, more efficient collection service.



EASILY OPERATED. Flick a lever and walk away—an entire loading and packing cycle completes itself in 22 seconds. Bulldozer action of packing plate "rolls" load out of hopper . . . exerts horizontal pressure to compress more refuse into the body. The Colectomatic's operating mechanism runs intermittently (not continuously as with chain-type) . . . reduces unproductive wear, cuts down on noise.

EASILY SERVICED in a matter of minutes. Simply open side panels of tailgate and lubricate mechanism from standing position. Entire operating mechanism is easily accessible for routine inspection and adjustment.

Get all the facts from your Heil distributor. Ask for a demonstration and see for yourself how the Colectomatic's simplicity-in-action can lower refuse collection costs for you.

BH-62

NEW HEIL MOVIE, "Made to Order," describes new Colectomatic in full sound and color. Address requests for free use to The Heil Co., Body and Hoist Division, Milwaukee 1, Wis.

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Factories: Milwaukee, Wis., Hillside, N.J., Lancaster, Pa.

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Eliminate Pollution

Mitchell, S. D., formerly burned refuse in an open dump, which, of course, was undesirable from the standpoint of odors and possible spread of disease. Now the city has switched to cleaner, landfill methods. An Allis-Chalmers 32,000-lb HD-11G tractor shovel handles spreading, compacting and covering. "It is doing a wonderful job for us," says Marshall Adams, city street superintendent. "We figure that in about two years the machine will have completely filled the 30-ft deep gully where we are working now; then we will start it on a program using trench-type landfill."

Need more facts about advertised products? Mail your Readers' Service card now.

Cut Disposal Costs

Jackson, Miss., has reduced rubbish and garbage disposal costs by as much as 75 percent through applying the landfill method of operation, according to H. B. Milstead, superintendent of sanitation. The city collects approximately 40,000 tons of refuse annually from homes and stores, and also disposes of an additional volume of rubbish hauled in independently from manufacturing plants. Last fall the city purchased its third new Allis-Chalmers crawler tractor in three years for sanitary landfill work—this one a 2½-yd. HD-11G tractor shovel. These spread, compact and cover the refuse. Already much useless lowland and marsh around Jackson has been reclaimed through this method, and has been converted into parks, golf courses and storage areas.

Communities Find Many Advantages in Sanitary Landfill Using Allis-Chalmers Crawlers and Tractor Shovels

Reclaim Waste Land

A 36-acre box canyon in San Fernando Valley, near Los Angeles, Calif., is being filled by sanitary landfill method, and eventually will be completely reclaimed as useful land. The project is being handled by Moe-Holland Co. as a private undertaking. Rubbish is hauled in from various towns in the northern end of San Fernando Valley, dumped in the canyon and thoroughly compacted by an Allis-Chalmers HD-16 crawler tractor with hydraulic dozer. The unit weighs over 38,000 lb. This operation not only reclaims land, but helps eliminate the burning of rubbish which contributes to smoke trouble in the area.

For a copy of the booklet, "Sanitary Landfill, An Important Community Benefit," and for complete information on equipment, see your **ALLIS-CHALMERS** *Construction Machinery Dealer:*

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ECONOMY . . . . Many cities boast 25 years of maintenance-free service from an American Concrete installation.

Here in Memphis, Tennessee . . . Hy-Lites will retain their "new look" year after year. To learn more about Hy-Lite features request Catalog No. 300. Write: American Concrete Corporation, 5092 North Kimberly Avenue, Chicago 30, Ill.

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PRESTRESSED CONCRETE LIGHTING STANDARDS

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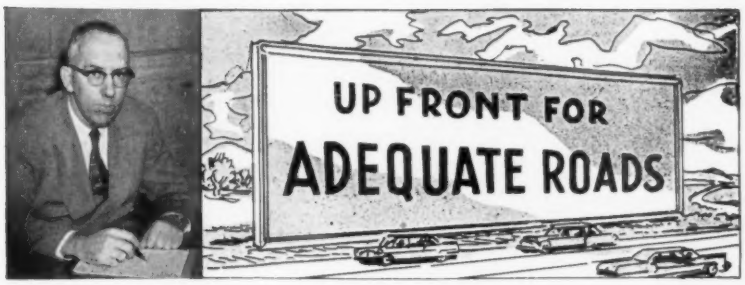

by LEO J. RITTER, JR.

HRB Meeting — Quite unexpectedly, your writer got to spend a couple of days at the Highway Research Board meeting in January. This time — making the first such occasion since the end of the war — the whole show was held under one roof, that of the Sheraton Park Hotel. Incidentally, the Sheraton Park has facilities for handling a meeting of this type which are about as fine as those of any hotel in the country. For our money, holding the meeting under one roof made all the difference in the world. It was possible to pop in and out of the meetings which were running concurrently—a great boon to those of us who are interested in a lot of different things. As usual, there were a large number of papers given, on every possible phase of research—seemed to us that this year there were more papers of directly practical nature than usual, with less emphasis on theory and obscure details. All in all, it was an excellent meeting, even if a certain general, in making one of the major addresses, did place Indiana on Lake Erie! A fairly large number of the papers dealt with topics of direct interest to local engineers and officials; a couple of them are abstracted in this column.

Priority Ratings in Indiana — One of the most interesting papers presented at the HRB meeting was one by John E. Baerwald, now of the University of Illinois and formerly of the research staff at Purdue. Subject of his very comprehensive paper was "Improvement Priority Ratings for Local Rural Roads in Indiana." The report presents the results of a study designed to develop rational procedures for the classification and improvement priority rating of local rural roads in that state. Among other things, the study resulted in the development of a formula for priority rating; factors which appear in the formula are the "service rating" and the "road rating". The service rating is a number expressing a relative summation of information describing the need for or the use made of a section of highway, while the road rating is a number expressing a relative summation of information describing the physical condition of the same section. When the priority ratings are obtained, they portray the relative needs of the various sections of the highway system. This is, of course, another extension of the "sufficiency rating" approach; technique and thoughts detailed in Professor Baerwald's paper will aid any local engineer or official in classifying and rating units of his own local highway system. Of course, a great deal of information must be gathered in actually rating any system; the time, money, and expense involved are worth while, because of the basis which is thus established for long-range planning to meet the needs of the system.

IBM and Others — An extremely interesting and significant paper given at the Washington meeting was one by a group of supervisory personnel from the California Division of Highways; it is entitled "Utilizing Business Machines in Traverse and Earthwork Computations." This paper describes the use of electronic calculating machines (actually, the IBM Electronic Calculator, Type 604) and associated equipment in speeding up these laborious calculations. Tabulated information of this type is fed to the central office from the various district offices, the machines go to work, and the results are promptly mailed back to the originating office.

Savings of time are fabulous with this approach. For example, on a divided highway project, ten miles in length, the engineer was furnished, within ten working days after completion of punching operations in the central office, computed elevations and distances from centerline of catch points, areas and volumes of cut and fill, and ordinates for a mass diagram. Processing of the punched cards was accomplished

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POWER PUMP for all models of GREENLEE Pipe Pushers. Makes the toughest pushing jobs simple, fast for *one man*. Average pushing performance: two feet per minute. Write today for complete details on timesaving GREENLEE Hydraulic Pipe Pushers.

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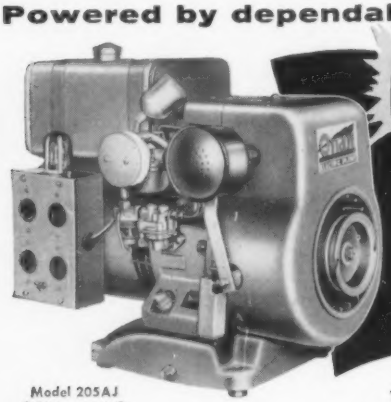

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Model 205AJ
2,500 watts A.C.

Put more power on the job!

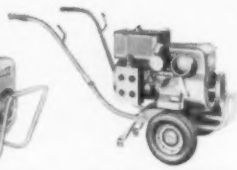
These new power-packed electric plants are smaller . . . lighter . . . easier to take along and move around. Model 205AJ shown here weighs only 154 pounds . . . *yet it develops 2,500 watts A.C.*

Multiple receptacles allow direct plug-in of several floodlights or heavy-duty electric tools, supplying a whole crew with labor-saving electric power.

These new plants are completely Onan-built with Onan engines direct-connected to Onan generators for trouble-free long life. Carrying frames and two-wheel dollies are optional equipment.

Onan Portable Electric Plants: 500 to 5,000 watts.

CARRYING FRAME for hand lifting and moving.



TWO-WHEEL DOLLY for easy moving by one man.

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Dotmar Paver with extensions paves integral gutter, curb and sidewalk.

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by tabulating personnel and professional supervisors in a non-engineering classification. This compares with estimates of four engineering man-months to do the equivalent work in the district office.

The use of business machines—together with the expanded use of aerial photogrammetry and two-way radio—offers probably the greatest potential for improving the productivity of highway engineering organizations in years to come. They can and will be of great help in solving the shortage of highway engineering manpower—the shortage which looms on the horizon as a threat to the execution of an expanded highway program.

Miami Beach – We didn't make it to the ARBA meeting in Florida, but hear that it was a real good show—despite the coldest weather in recent history. They sent us all the papers, but there didn't seem to be too much that needed abstracting here, although some were very interesting. One I enjoyed reading was a paper by Henry Aaron of the Wire Reinforcement Institute on reinforced concrete pavements; Henry fired the opening round in what promises to be another battle over the merits of plain and reinforced concrete and other details of pavement design. A couple of other groups—other than PCA—are taking renewed interest in this problem, and widespread technical differences of opinion will make very interesting reading for the next couple of years. It was said that the materials and supplies exhibits were very good, although some of the manufacturers seemed to feel that there wasn't enough time between convention sessions to allow the delegates to look over the exhibits. The big push is on for the 1957 Road Show; if you're thinking of exhibiting there, you had better get your money in right now.

Names 'n Stuff — The highway world was shocked by the untimely death of General Frank Merrill of New Hampshire a few days after his election as President of the AASHO; Rex Whitton of Missouri will serve in his place. Some of us were also saddened by the death of Don W. Taylor, Professor of Soil Mechanics at MIT, on Christmas Eve. Harry Seaman, who terminated his association with Seaman-Andwall of Milwaukee, will devote himself to other interests, one of which is the new Seaman-Gunnison Corp. of Baraboo, Wisconsin; one of their new products is a combination steel-wheel and pneumatic-tire roller.

with

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Meets the economy requirements of designers, builders and taxpayers with:

- ★ **GREAT STRENGTH** for safety under "tough" conditions.
- ★ **DENSE STRUCTURE** to assure highest carrying capacity.
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In planning **your** concrete sewers and drains, plan on using UNITED STATES Concrete Pipe. It's your assurance of a successful installation, now, and from now on.

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GENERAL CONTRACTOR: C. J. Langenfelder, Baltimore, Md.

DRAINAGE CONTRACTOR: Lippi Construction Co., Hammonton, N. J.

PIPE: 66" Reinforced Concrete Culvert Pipe, 8-foot lengths, from Croydon, Pa., plant of United States Concrete Pipe Company.

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The first issue of the new *Journal* of the Highway Division of ASCE is fresh off the press; this is the new form of publication which replaces the older *Proceedings Separates*. This first issue contains a paper on the Analysis of A Skew Diversion and a symposium (5 papers) on the Control of Highway Access.

County Salaries — The County & Local Roads Division of ARBA has issued an interesting tabulation of the salaries of County highway engineers during 1955. Admittedly incomplete, salaries are tabulated from 19 states. The report has the overall objective of aiding in raising highway engineers' salaries to a level which is competitive with private industry; this, in turn, is one of the vitally important steps which must be taken in order to attract more engineering graduates to the highway field. That there is room for improvement is shown by the fact that, of some 600 or so salaries tabulated, 42, or less than 10 percent, are $10,000 or more. That's ridiculous, when you consider the responsibility carried by many of these men and the size of the programs many of them administer. Highest salary reported was that of the county highway engineer of Wayne County, Michigan (Detroit) —$20,000 plus. Incidentally, highway engineering manpower—or the lack of it—is one of the major topics of discussion in highway groups.

From Here and There—The 66-mile extension of the Maine Turnpike—from Portland to Augusta—was opened just before Christmas; the pavement consists of 3 inches of asphaltic concrete, 4 inches of penetration macadam base course, 13 inches of gravel base, and 20 inches of improved subgrade. Florida's 1955 state highway construction program was the biggest in history of that state; about $80 million of work placed under contract. Wilbur K. Smith & Associates of New Haven, Conn., have been selected to prepare a preliminary feasibility report to determine if the state of Alabama is justified in building a toll road; Joseph K. Knoerle and Associates of Baltimore will also participate in the study. All legal obstacles which delayed the final sale of Illinois' $415-million of toll road bonds were cleared away late in January; design and construction will now proceed apace, since the interest charges amount to something like $50,000 per day. The Automotive Safety Foundation is currently carrying on studies in Rhode Island, Montana, and Ontario Province, Canada; the next big highway needs study may be in Alabama.

• • •

Los Angeles Emergency Well Handled

A recent local storm provided a severe test for Los Angeles Street and Sewer Maintenance forces and proved the microwave communication system with approximately 160 vehicles in the field to be invaluable. Workmen on these vehicles were quickly dispatched to needed locations as these were reported to the main and branch City Halls and other outlying offices. Reports and requests for street clearance and other necessary jobs were relayed through the Street Maintenance radio panel on the 7th floor of the Los Angeles City Hall.

All vehicles of Street and Sewer Maintenance were busy meeting emergency storm conditions. Street resurfacing and repair crews and lot and street cleaning personnel were diverted from their usual assignments to respond to the many calls that were received throughout this City of some 6300 miles of streets.

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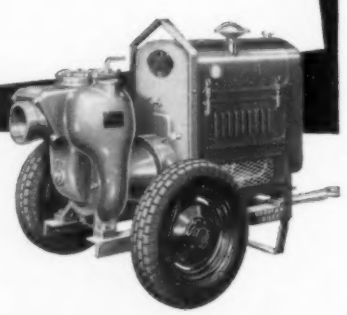
Mansfield, Ohio



Sizes: 1½", 2", 3", 4", 6", 8", 10". Every pump covered by this plain-language guarantee!

Gorman-Rupp PUMPS

THE GORMAN-RUPP COMPANY
305 Bowman St., Mansfield, Ohio

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Parlon® Stays On!

An "All-Purpose" Municipal Paint

FOR GOOD RESISTANCE to coal gas, chemicals and chemical fumes, the New York City Transit Authority selected a Parlon-based paint for these new coal unloading towers. The tower was designed and built by Mead-Morrison Div. of the McKiernan-Terry Corp. The paint is RIW Korosist Chlorinated Rubber Base Paint, manufactured by Toch Brothers, Staten Island, New York.

Across the nation an ever-increasing number of municipalities are discovering the unique properties of paints based on Hercules Parlon (chlorinated rubber).

Wherever protective coatings must stand up to a demanding challenge—whether the requirement be traffic paint, or for a sewage plant; exterior finishes for masonry buildings, or interior protection for metal equipment—Parlon-based paints are providing longer service at lower long-term cost.

Parlon's unusual ability to withstand the corrosive effects of chemicals and salt water atmosphere plus its adaptability to masonry, wood and metal surfaces makes it the ideal all-purpose maintenance paint. Your local paint supplier can provide additional information, or write direct to Hercules.

Cellulose Products Department
HERCULES POWDER COMPANY
INCORPORATED
978 King Street, Wilmington 99, Del.

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PARLON CHLORINATED RUBBER PAINTS ARE AVAILABLE FROM 400 MANUFACTURERS UNDER THEIR OWN BRAND NAMES

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Made to Order for MUNICIPAL USE

A Complete Line of Gasoline Engine Portable Power Tools to speed your work...to cut your costs.

Here's a power packed MALL 2-cycle gasoline engine designed to do many municipal jobs. This lightweight, compact and highly maneuverable engine can power a dozen attachments. These attachments save time and money for your community and can be purchased as the need for each arises.

This engine, coupled with attachments, gives you two or more power tools for the price of one. And, you can depend on MALL for the highest quality, top performing power tools available at the lowest price.

MALL TOOL COMPANY PORTABLE POWER TOOLS GASOLINE • ELECTRIC • AIR

7752 South Chicago Ave., Chicago 19, Ill.

Send me the Free Gas Engine Tool Catalog—tell me more about MALL TOOLS for municipalities.

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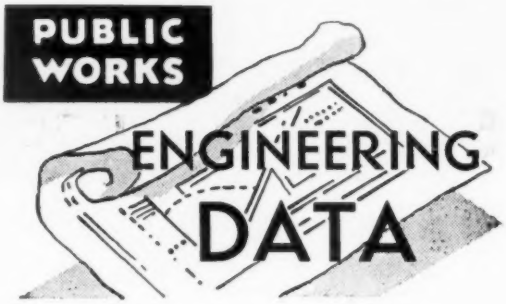


Refuse Handling by Sanitation Districts Proposed for Los Angeles Area

Under a proposed plan, the organized sanitation districts in Los Angeles County, Calif., will receive refuse collected by the member cities and transfer and dispose of it. Each of the cities would perform the original refuse collections within its own limits and would deliver the waste to transfer stations owned and operated by the districts; and the districts would transport the refuse to landfill disposal sites. There are 18 organized sanitation districts in the county and the plan would apply to 39 of the 46 cities.

The report on the plan recommends a single pick-up for all wastes, with no consideration being given to hog feeding, paper salvage or separation into garbage, combustible and non-combustible groups.

A Major Water Study

Stanley Engineering Co., Muscatine, Iowa, and Chicago, Illinois, was recently retained for an engineering study on the feasibility of bringing Lake Erie waters to a 4,000 square-mile, six-county northeastern Ohio area. The Lake Erie Watershed Conservation Foundation of Cleveland, Ohio, signed a contract with Stanley Engineering Company to examine the existing water works in an effort to determine present supply and demand for the area. This study will include an estimate of population and industrial growth as well as the agricultural requirements for water within the six counties. One of the purposes of such a study is to reveal the deficiencies, if any, in the present water supply; and if deficiencies are exposed, to recommend a feasible way to utilize Lake Erie waters to supply the six-county area.

The survey, which takes in Cuyahoga, Geauga, Ashtabula, Portage, Summit and Lake counties, is needed because the area's water supply has dwindled over the years, and the quality of its water often has been poor.

Public Works and Street Operations in Granite Falls

In the excellent annual report of Granite Falls, Minn., activities of the Public Works and Streets Departments are stated as follows:

The Public Works Department, as its name indicates, is responsible for most of the city construction. Under this department, a multitude of different projects and tasks are performed. Last spring, over 75 loads of leaves, dirt and debris were removed from the streets. Normal jobs include cleaning out sewer manholes and catch basins several times each year; flushing sewers, patching and maintaining the bituminous and gravel streets; cutting weeds, trees and brush; cleaning and washing streets; plowing and

2 fast, economical M-B LINE MARKERS

LOW COST, COMPACT MODEL 6-18. Built for the county with limited marking requirements — an easily handled, 18 gallon capacity machine with features usually found only in higher priced markers. The Model 6-18 marks curved lines as easily as straight — solid or intermittent with regular or reflective paint. Heavy duty paint guns have jet spray tubes laying sharp lines 3" to 6" in width. Travels 3 to 5 miles per hour; built-in riding trailer provided.

With all these big-unit features, the M-B Model 6-18 is easily the most handy marker on the market today.

HEAVY-DUTY, HIGH PRODUCTION SUPER 10. One man can handle any highway marking need with this self-propelled M-B Super 10 marker. Lays one, two or three lines, 2" to 6" wide, in 2 colors — solid or intermittent. Bead dispensers available. Large paint capacity — up to 120 gallons. Powerful 14 hp engine gives travel speeds up to 10 MPH. Three speeds forward and one reverse. Telescopic wheel-type caster guide assures accuracy — jet spray tubes guarantee sharp, clean lines.

All M-B Line Markers feature the largest strainers available — up to 180 sq. inches; standard make guns; positive paint agitation with paddle-type agitators; and largest standard tank capacities — from 11.2 gallons to 1,000 gallons.

SEE THE COMPLETE LINE of big production M-B Markers and special "made to order" truck-mounted models — they meet every highway department requirement! Send for free catalog today.

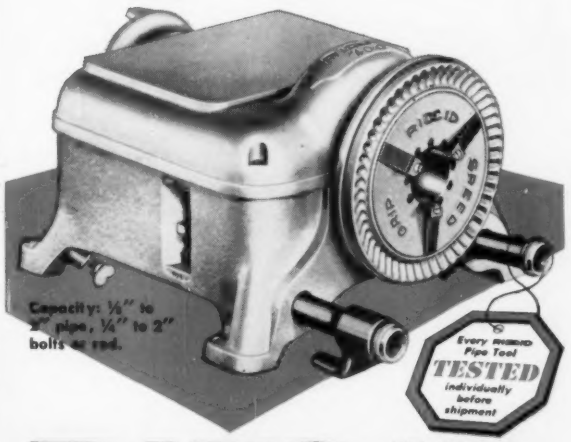
M-B CORPORATION
NEW HOLSTEIN, WIS.

PACKER BODIES • LINE MARKERS • SWEEPERS • PAINTS AND BEADS

MANUFACTURERS OF QUALITY MUNICIPAL AND CONSTRUCTION EQUIPMENT SINCE 1907

...Don't overlook this speedier Power Drive

that takes the work out of pipe threading, cutting, reaming...



RIDGID

400A with wrenchless SPEED CHUCK

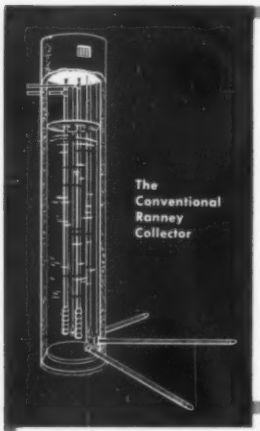
Lots of ready power turns pipe, conduit or rod for your hand threaders, cutters, reamers—even up to 12" geared tools with drive shaft. New Speed Chuck opens and closes easily, guaranteed to grip tight forward, reverse; jaws have replaceable insert teeth for longer life. Light, compact, portable—built for years of service. Bench, stand and wheelstand models. See and try the 400A—at your Supply House!

RIDGID 504
quick-opening threader for power drive use—self-contained dies for 1" to 2" pipe or conduit.

"Threaded Pipe—It's Tight—It's Best—Costs Less"

RIDGID
Work-Saver Pipe Tools

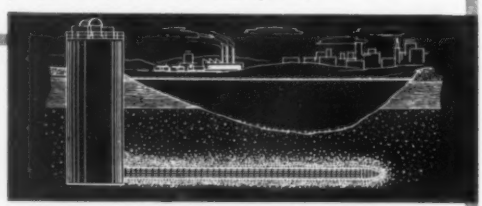
The Ridge Tool Company • Elyria, Ohio, U.S.A.



NOW a RANNEY METHOD for every WATER NEED...

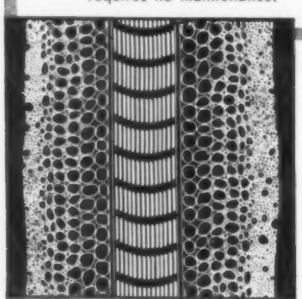
the CONVENTIONAL Ranney Collector

Proven by countless installations around the world, the collector yields naturally filtered water with less equipment, less personnel, and fewer pumps than other conventional systems.



the Ranney INFILTRATION GALLERY

Engineered by Ranney to provide low cost water supply to industry and community. The Gallery provides large quantities of clear non-turbid water in a revolutionary yet economical way. The Gallery requires no maintenance.



the Ranney VERTUBE well

Developed exclusively for low volume users. It provides a natural gravel vertical water well at low cost. The Ranney Vertube is engineered with the same precision and efficiency as its two bigger brothers.

- Ranney provides naturally filtered water at low cost
- a water program for every community and industry
- Ranney engineering research provides the latest modern water supply techniques.

AMONG THE MANY RANNEY USERS ARE: Industries: Granite City Steel Co., U. S. Steel Corp., Eli Lilly and Co., Shell Oil Co., Monsanto Chemical Co., E. I. duPont de Nemours and Co., Timken Roller Bearing Co. Cities: Boise, Idaho, Canton, O., Parkersburg, W. Va., Manitowoc, Wis. Write to Dept. PW-5

RANNEY METHOD
Water Supplies Inc.
Water Supply Engineers and Contractors
841 Alton Columbus 19, Ohio
Associate: Ranney Method Western Corporation

hauling snow; clearing snow from the city owned city walks; flooding and maintaining two skating rinks; and many other maintenance tasks.

In addition to performing these normal duties, the Public Works men are responsible for construction of all the sewer and water main extensions. It is believed that a record amount of sewer and water main was installed this past year. A total of 4142 feet of cast iron water main was installed. Total sewer main construction amounted to 3712 feet. In addition to the mains that were installed, 22 sewer and water services were installed with a total length of over 668 feet.

A near record amount of concrete curb, gutter and sidewalk was installed. A total of 2920 lineal feet of sidewalk was poured. Total curb and gutter construction amounted to 4225 lineal feet. Actual construction of the concrete work was accomplished by contract, but a good share of the excavation or fill for the concrete work was performed by the Public Works Department. The cost of the concrete improvement is borne by the abutting property owner, but the cost of preparing the ground or grade is absorbed by the City.

The cost of sewer and water improvements in Granite Falls is considerably more than in most cities, due to our unusual rock condition. In prior years, a nominal charge was assessed against the abutting property, but the City absorbed the biggest share of the cost of improvement. Recently, the City Council reviewed closely the cost of several projects installed the past year. After much discussion, the assessments for sewer and water improvements were increased. The current rate is still less than the actual cost of normal construction.

San Antonio Employs "Parking Hostesses"

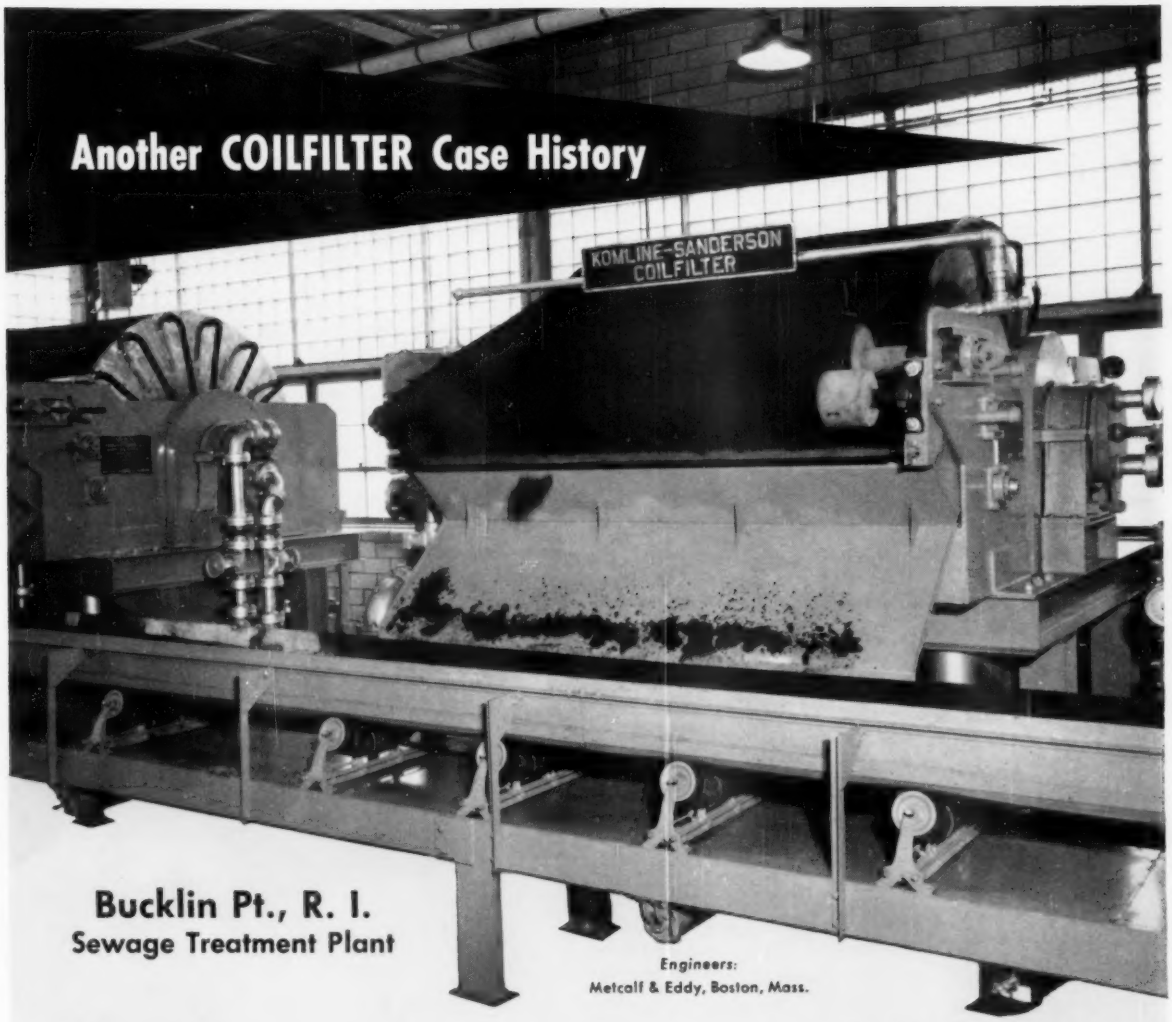
Six women are being employed by San Antonio, Tex., to act as "parking hostesses". Their duties will include (1) issuing tickets for overtime parking in the downtown metered area; (2) giving out information on bus schedules, tourist sites, hotels and street hotels and street locations; (3) acting as city hostesses at conventions and other events and supplying information to visitors; and (4) promoting good will for the city. They will work a 5-day 40-hour week.

In order to fit them properly for the work, a training program of 160 hours, covering four weeks has been prepared. This covers five major topics; (1) Indoctrination lessons and tours of city facilities and departments; (2) general briefing and local geography and features; (3) traffic meters and meter locations; (4) grooming and etiquette (at a School of Modeling); and (5) tours, field training, and examinations.

S. J. Matthews is City Manager of San Antonio.

A Water Department Reports

The following material is from the 42nd Annual Report of the Pasadena Water Department, Pasadena, California. As of June 30, 1955 there were 2035 fire hydrants in use in Pasadena and 38,915 domestic water meters in the water system. The average yearly temperature of the water in the mains for the last fiscal year was 68°F. with the lowest temperature in January at 55°F and the highest in July at 80°F. The average water consumption was 177.9 gallons per capita per day during the last fiscal year which compared with 184.7 gallons per capita per day for the previous year. There has been an increase in the per capita use of water since 1941-42 of 48.9 percent.



Another COILFILTER Case History

Bucklin Pt., R. I.
Sewage Treatment Plant

Engineers:
Metcalf & Eddy, Boston, Mass.

The Bucklin Point Sewage Treatment Plant in East Providence, R. I., operated by the Blackstone Valley Sewer District Commission, is a primary treatment plant with digestion and elutriation, designed to serve a population equivalent of 210,000, with a flow rate of 47.2 MGD and an average of 19,500 lbs. of sludge to be dewatered per operating day.

Three 100 Sq. Ft. COILFILTERS which dewater the sludge at Bucklin Pt., started operating in 1953. These units have performed excellently from the start, producing an average filter rate of 6-7 lbs. per hour per Sq. Ft. of filter area. Operating cost has been extremely low, only 2-3% ferric chloride being used to condition the sludge. No special maintenance is required. Two COILFILTERS are normally operated daily. Filter cake is discharged to a belt conveyor and then hauled away by truck to a sanitary fill.

C. V. (Buck) Hickey, Plant Superintendent, states: *"We have been very pleased with our* COILFILTERS *from the beginning, due to their outstanding performance, dependability and low operating cost. In addition, the ease of maintenance, partly due to the accessibility of all points requiring lubrication and adjustment, combined with the excellent general layout of this plant, make this a truly modern installation."*

Remember . . .
COILFILTER
. . the proved leader
of sludge vacuum filters

KOMLINE-SANDERSON ENGINEERING CORPORATION
Peapack, New Jersey
Manufacturers of COILFILTER Sludge Vacuum Filters

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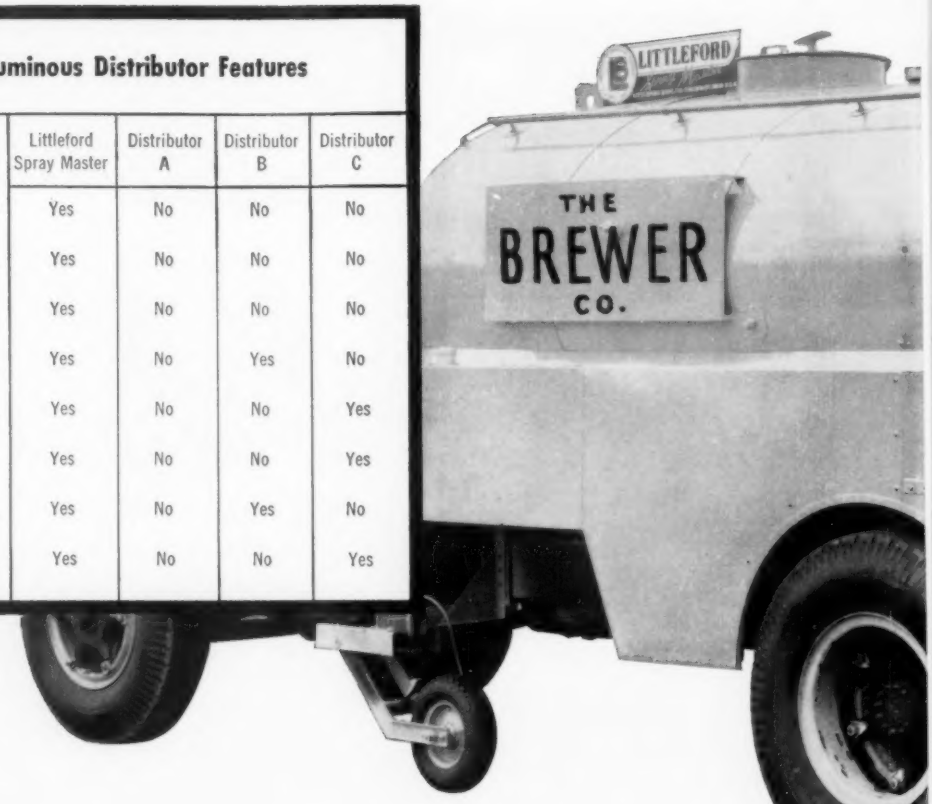
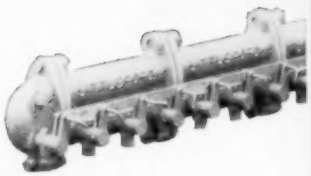
Comparison of Bituminous Distributor Features

	Littleford Spray Master	Distributor A	Distributor B	Distributor C
Multi-pass continuous heat flue system?	Yes	No	No	No
Patented damper?	Yes	No	No	No
Air-cooled flue liner?	Yes	No	No	No
Patented single valve control?	Yes	No	Yes	No
Right-angle drive?	Yes	No	No	Yes
4-speed transmission?	Yes	No	No	Yes
Full area circulating spray bar?	Yes	No	Yes	No
Hydraulic spray bar lift?	Yes	No	No	Yes





Contractors compare and find

LITTLEFORD SPRAY MASTER

Bill Brewer, of The Brewer Co., Madeira, Ohio, leading asphalt contractors, has two Littleford Spray Masters. Like many other progressive contractors, Bill compared the rest and found Littleford best . . . for the 8 big reasons listed in the chart above.

Contractors everywhere like the exclusive Littleford combination of design, construction and operating advantages that mean better spraying, faster and for less money.

Here are just two of the many time-saving features that will save you up to an hour a day:

(1) patented damper saves 30 minutes on starting time. It shuts off the flues, concentrates heat within the heat chamber, thus heating the pump, main valve and piping faster than any other unit.

(2) 2-section full area spray bar heats to spray temperature faster, saves 5 minutes on every load.

Now's the time to mail this month's Readers' Service Card.

Comparison proves that the Littleford Spray Master is the best engineered, most efficient, most economical and easiest to operate bituminous distributor on the market.

TOPS IN BITUMINOUS DISTRIBUTORS

And the Littleford Spray Master gives you so many operating advantages, you can turn it over to your operators with a minimum of instruction:

- A single patented valve controls spraying, filling, circulating and transferring.
- Hydraulic operated bar lift permits tilting the bar so that it is parallel to road surface despite angle of crown.
- 4-speed transmission with reverse — gives more flexible operation of pump.

There are many other reasons why we say "*compare* Littleford Spray Master, and you'll *buy* Littleford Spray Master." Send today for bulletin 14. Littleford Bros., Inc., 452 E. Pearl St., Cincinnati 2, Ohio.

BLACK TOP ROAD EQUIPMENT SINCE 1900

LITTLEFORD

TOPS IN BLACK TOP

Get full details of this month's products . . . mail your Readers' Service card today.

How City Manager Walton Taylor uses careful planning and CAT* equipment

TO GIVE MISSOULA A NEW FACE

Two No. 12s (1) rip up Missoula's potholed streets...(2) cut gravel from berm to mix with oil...(3) thoroughly work the oil mix...(4) lay mix on improved city streets.

230 miles of streets — too many of them going to potholes. Tight budget — getting tighter all the time. That was the problem in Missoula, Montana. That's the problem in lots of towns. Missoula's City Manager Walton Taylor is licking it with a vigorous 3-point program of reconstructing bad streets, seal coating the good ones, and putting in new drainage facilities. All the while, making every city dollar do 100 cents' worth of work.

Mr. Taylor had bought Caterpillar Motor Graders four times in the past, for other cities. So to help beat Missoula's budget squeeze, he turned to Caterpillar again.

He says, "My experience shows they're more economical, primarily because of the sturdiness with which they're built. They live up to their reputation for handling the hard jobs with no strain, and for taking long hours at low operating cost — with little or no down time." That's why Mr. Taylor has two Caterpillar No. 12 Motor Graders working for him right now.

The No. 12 has always been a cost-cutting machine. Now, two recent money-saving improvements make it a better buy than ever.

New exclusive oil clutch practically does away with disc replacement, cuts down time to the bone.

New tubeless tires eliminate costly tube and flap trouble, can reduce tire down time by 30%.

Its positive controls, clear visibility, fast and accurate blade positioning make the No. 12 easier to operate. Mr. Taylor likes it because it'll carry a full 14-foot blade for maintenance work as easily as a 12-footer. And there are dozens of other reasons why this big yellow 115 HP machine makes an ideal public servant. Let your Caterpillar Dealer give you complete details.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

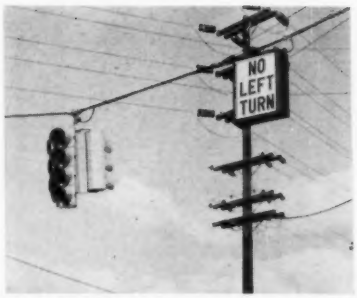
99% OF ALL CAT MOTOR GRADERS EVER BUILT ARE STILL AT WORK

Get full details of this month's products . . . mail your Readers' Service card today.

PUBLIC WORKS MAGAZINE

MARCH 1956

TRAFFIC CONTROL BY AUTOMATION



● **LIGHTS and signals direct traffic better than five officers could do it.**

A TRAFFIC control tower, operated by one man, has recently taken the place of five traffic policemen in regulating a flow of 40,000 cars a day at five intersections near the Miami International Airport, Dade County, Florida. The control board was designed by Lowell Powars, traffic engineer in the Duval County Engineering Department, who also supervised construction of the board and the small building in which it is housed. The total cost was about $8,000. The robot board is a remote control hook-up controlling the lights at these intersections: LeJeune Road and 36th Street; Okeechobee Road and 36th Street; Poinciana Drive and LeJeune Road; North River Drive and 36th Street; and State Road 27 and 36th St.

How to Cut Accidents?

The idea for such a control board came about because of the increasing traffic in the vicinity of the airport. Accidents were showing greater frequency. Traffic tie-ups were the usual thing in rush hours despite the five traffic policemen. At peak periods it sometimes took a car 18 minutes to pass through the traffic trap. At present, the tower is operated only during the rush hours from 3:30 p.m. on.

Dade County Police Chief W. T. Norton was first to suggest a one-man control operation. He discussed it with County Commissioner Hugh Peters and County Engineer E. A. Anderson. A meeting was called which was attended by representatives of industries in the area, the airlines and such affected communities as Miami Springs and Hialeah. Mr. Powars attended this meeting and subsequently spent many hours with Alexander Bilsky, Dade County electrical technician, and Ivan Pike, Miami signal technician, until a definite idea took form. Early in 1955, Powars was assigned the problem as a full-time job. By early fall he had the new system in operation. Here is how it works:

The control board consists of a curved panel, with five series of red, green and amber lights. Each series designates an intersection. The traffic officer on duty scans the intersections, anticipates possible traffic jams and presses the right button on the board to clear a possible jam before it starts. The traffic officer can control each intersection light singly or collectively. He uses his judgment based on traffic load and experience. He leaves a green light on long enough to clear a heavy traffic load moving in one direction.

A motor vehicle can now move down the span and over the Miami River canal bridge in two and a half minutes compared with 18 minutes at times under the old system. In the event of an emergency, the panel is so devised that each series of lights can be worked independently. If there is mechanical trouble, a change from panel operation to a single operation can be made in a second.

While the panel was designed for a unique situation—the funneling of traffic from several highways into 36th Street and over a single bridge—it could be adapted to any similar bottleneck situation with some changes, according to its designer, Lowell Powars.

● **BOARD shows layout at the five intersections. Traffic officer in control tower presses the right button to keep peak hour traffic moving most efficiently.**

Municipal Iron and

TWO OF THE most troublesome constituents which may occur in a water supply are iron and manganese. Both occur in much the same forms; both cause the same types of troubles; and both may be reduced to insignificant amounts by the same removal processes but there are some differences in their behavior.

As iron is the commonest in occurrence, it will be considered first. In different iron-bearing natural water supplies, the iron may be present in one or more of the following four forms: (1) Soluble ferrous bicarbonate; (2) soluble ferrous sulfate; (3) soluble organic (chelated) iron; (4) suspended insoluble ferric hydroxide.

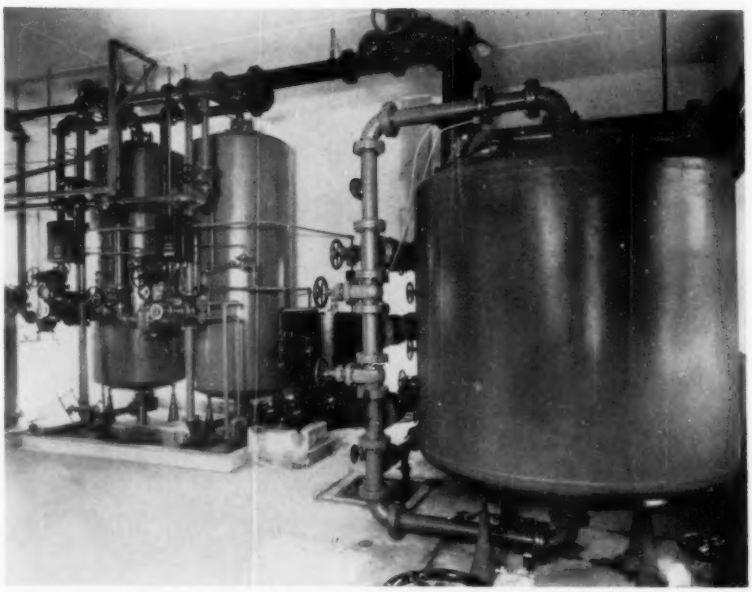
Frequently, also, a water supply which, at its source, is free from iron may have an appreciable iron content when drawn from the distribution system. This may be due to either corrosion or iron pickup.

When due to corrosion, the iron is present as insoluble suspended ferric hydroxide, creating the familiar "red-water". When due to iron pickup, the iron is present as soluble ferrous bicarbonate.

In selecting a method for iron removal, it is necessary to consider the form in which the iron is present and, if due to corrosion or iron pickup, to devise methods of stopping the contamination. These various problems will be discussed in the above listed order.

Ferrous Bicarbonate—In iron-bearing, clear, colorless, deep well or spring waters, which contain bicarbonate alkalinity, the iron is always present as ferrous bicarbonate, a colorless salt which exists only in solution. It has a very appreciable solubility and in cold water, saturated with carbon dioxide and free from air, it can dissolve to the extent of somewhat over 150 ppm expressed as iron.

Most alkaline, iron-bearing ground waters fortunately contain very much less than this maximum amount. In fact, the great majority of iron-bearing waters will contain less than 5 ppm of iron. Any water containing over 0.3 ppm of iron is definitely objectionable for municipal uses and should be treated so as to reduce its iron content to or preferably below 0.3 ppm. For most industrial uses, the tolerance for iron is 0.1 ppm.



● **IN THE Martinsville, Ill., plant, aerated and settled water is filtered in units at right, and 70 percent of hardness then removed by zeolite softeners shown at left.**

Most of the iron-bearing deep well waters which contain ferrous bicarbonate are clear and colorless when first drawn. On standing in contact with air, they first develop a whitish haze which gradually darkens and precipitates yellowish-brown to reddish-brown ferric hydroxide.

As this is a sticky, gelatinous insoluble material, waters which contain ferrous bicarbonate tend to stain and discolor everything with which they come in contact. Water pitchers, tumblers, china, bathtubs, washbowls and toilets develop ugly, rusty stains so that one of the commonest items in a household plagued with irony water is a bottle of muriatic acid for removing iron stains.

However, this is a losing battle for no sooner are the stains removed than they start forming again. Also, the muriatic acid dims the luster of the porcelain fixtures and in time eats through to the metal beneath.

Laundering in such waters is practically impossible for even with a relatively small iron content, there is no even spreading out over the material. Instead the iron tends to congregate in masses and produce large rust stains.

Iron-bearing waters also make muddy coffee and turn tea black, which is quite natural for the ferrous iron of the water and the tannic acid of the tea unite to form a dilute ink. Whisky, that is aged whisky, also turns black when mixed with this kind of a water for the whisky has taken up tannic acid from the keg while it was being aged. As for white mule, fresh from the still, iron-bearing water wouldn't turn it black for there's no tannic acid present so possibly it might improve the flavor although that's a rather large contract to fill.

Iron-bearing waters also favor the growth of iron bacteria, commonly called *crenothrix*, and these cut

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Eskel Nordell is also the author of "Water Treatment for Industrial and Other Uses". (Reinhold Publishing Corp., N. Y.) Tables 1-5 are reprinted by permission from this book.

ESKEL NORDELL, Director of Technical Information, The Permutit Company

Manganese Removal

down the flow rates in pipe lines. Also, at times, they break loose in masses which may clog meters, nozzles and water fixtures. In addition, when these growths decay, they impart objectionable tastes and odors to the water.

Manganous Bicarbonate — In clear, colorless, maganese-bearing deep well waters which contain bicarbonate alkalinity, the manganese is present as manganous bicarbonate. Like ferrous bicarbonate, manganous bicarbonate is a soluble, colorless salt which exists oniy in solution. In water, saturated with carbon dioxide, its solubility at 65°F is 191 ppm. expressed as Mn.

In most manganese - bearing ground waters containing bicarbonate alkalinity, the amount of manganese present will be less than 1 ppm as Mn. Few will run above 3 ppm. Most manganese-bearing waters also contain iron and usually the iron is present in greater amounts than the manganese. On exposure to the atmosphere, the iron usually oxidizes fairly rapidly while the manganese, at the pH values usually prevailing in natural water supplies, oxidizes very slowly.

Therefore, the reddish yellow ferric hydroxide masks the manganese and often leads to the erroneous impression that the water is merely an iron-bearing water. It is best, therefore, to check for manganese as well as for iron. In those waters which contain manganous bicarbonate but only negligible amounts of iron, the manganese oxidizes slowly to form grayish to black deposits and stains. In laundering, due to higher pH of the wash water, the manganese oxidizes more rapidly and produces very disagreeable gray and black stains. Manganese also favors the growths of *crenothrix*.

Removal Processes

Iron and/or manganese, in municipal water supplies, when present as the divalent bicarbonates may be removed by aeration, settling and filtration; by the cold lime-soda process; by a zeolite (sodium cation exchanger) process; or by a manganese zeolite process.

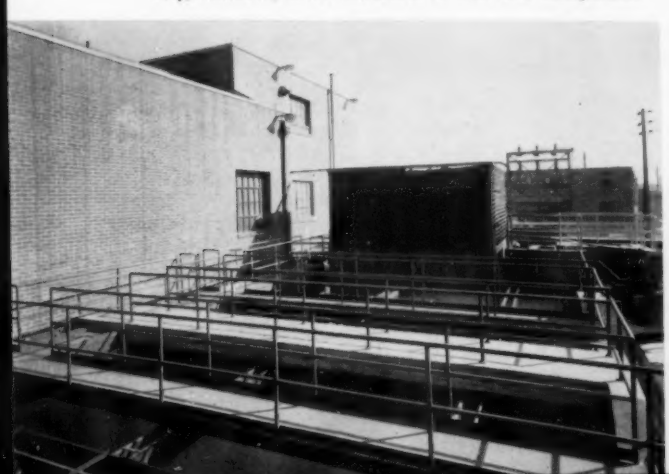
Aeration, Settling and Filtration— When ferrous bicarbonate is oxidized, it is transformed into the practically insoluble ferric hydroxide (the solubility of ferric hydroxide is less than 0.01 ppm expressed as Fe). This oxidation can be effected by either air or chlorine and, since the latter has to be purchased while the former is free, air is most widely used. In addition to being cheaper (of course, aeration is not absolutely free for a loss of head and/or the cost of operating a blower may be involved) aeration has the added advantage of reducing the free carbon dioxide content of the water and raising its pH value.

As shown in Table 1, this oxidation with air proceeds rapidly at a pH of 7.0 or over. With waters having a sufficient content of bicarbonate alkalinity, aeration alone is sufficient to raise the pH above 7.0 and effect a rapid oxidation of the iron. In other cases, lime (or caustic soda or soda ash) is added to the aerated water. The theoretical amount of iron that will be oxidized by 1 ppm of oxygen is 7 ppm.

While the oxidation of ferrous bicarbonate by oxygen is best carried out at a pH of 7.0 or above, chlorine, as shown in Table 2, will effect a complete oxidation at a pH as low as 5.0. The amount of chlorine required is rather high as 1 ppm of chlorine will oxidize only 1.6 ppm of ferrous iron. However, chlorine presents some advantages at the lower pH values when the content of iron is rather low or, in some cases, as a secondary treatment when the bulk of the iron has been removed by aeration.

Several types of aerators are used but the most common type are the coke tray aerators. These may be made of either metal or wood; in either cylindrical or rectangular design and with either 3 (commonest) or 4 coke trays. Other types quite widely used are the wood slat tray and the enclosed forced draft.

● **WOOD slat tray aerator, in background, at the N. Kansas City, Missouri, is for oxidation of iron and manganese.**



● **AERATED and softened water is passed through gravity filters in the North Kansas City, Mo., plant shown here.**

TABLE 1—Iron: Effect of pH on the Oxidation of Ferrous Iron by Dissolved Air

Raw Water		Iron in Aerated and Filtered Water (ppm)		
pH	Iron (ppm)	(15 min.)	(30 min.)	(60 min.)
5.0	10.0	9.0	—	7.5
5.5	10.0	5.5	4.6	4.0
5.95	10.0	5.0	4.0	3.5
6.15	10.0	4.4	3.5	2.5
6.5	10.0	2.8	1.8	0.3
6.65	10.0	0.7	0.2	0.1
6.8	10.0	0.2	0.1	<0.1
7.0	10.0	0.1	<0.1	<0.1
7.45	10.0	0.1	<0.1	<0.1
8.05	10.0	<0.1	<0.1	<0.1

TABLE 2—Iron: Showing That Chlorine Oxidizes Ferrous Iron at a Lower pH Than Dissolved Air

Raw Water		Iron in Treated and Filtered Water (ppm)		
pH	Iron (ppm)	(15 min.)	(30 min.)	(60 min.)
4.0	10.0	—	—	0.8
4.55	10.0	—	—	0.5
5.0	10.0	<0.1	<0.1	<0.1

TABLE 3—Manganese: Effect of pH on the Oxidation of Manganous Manganese by Dissolved Air, Without Stirring

Raw Water		Manganese in Aerated and Filtered Water (ppm)		
pH	Manganese (ppm)	(15 min.)	(30 min.)	(60 min.)
8.5	10.0	—	—	10.0
9.0	10.0	—	—	9.0
9.3	10.0	8.5	8.0	7.5
9.5	10.0	7.5	5.0	3.2
9.7	10.0	3.0	1.3	0.9
9.95	10.0	0.9	0.7	0.6
10.3	10.0	<0.02	<0.02	<0.02

TABLE 4—Manganese: Catalytic Effect of 1 Gram per Liter of Aerated and Precipitated Manganic Hydroxide, With Stirring, on the Oxidation of Manganous Manganese at Various pH Values

Raw Water + Catalyst		Manganese in Aerated and Filtered Water (ppm)		
pH	Manganese (ppm)	(15 min.)	(30 min.)	(60 min.)
7.5	10.0	—	—	3.0
8.0	10.0	—	—	0.3
8.5	10.0	<0.1	<0.1	<0.1
9.0	10.0	<0.1	<0.1	<0.1

TABLE 5—Manganese: Effect of pH on the Oxidation of Manganous Manganese by Chlorine, Without Stirring

Raw Water		Manganese in Treated and Filtered Water (ppm)		
pH	Manganese (ppm)	(15 min.)	(30 min.)	(60 min.)
8.05	10.0	—	—	9.0
9.0	10.0	8.0	6.5	5.0
9.45	10.0	4.5	2.5	1.3
10.0	10.0	0.3	0.1	<0.02

Where removal of free carbon dioxide is not required, only a small amount of iron is involved and it is desired to conduct the operations under pressure, a pressure type aerator may be employed, followed by filters, usually of the pressure type. Open tank aerators in which air is bubbled through the water are rather inefficient, and since they are more expensive to operate, they seldom are used where large quantities of water must be handled.

Following the aerator, a catch basin or settling basin should be provided. These vary in size but for most iron-bearing waters the detention period should preferably be not less than 30 minutes and a 1-hour period is better. However, with waters containing only small amounts of iron it is fairly common practice to use catch basins with only a 15-minute detention period. Needless to state, with very short detention periods, little or no settling is effected in the catch basin so usually the whole load goes over on the filters. When large amounts of iron are present, the sludge blanket type of coagulation and settling equipment is very efficient in reducing the load on the filters.

The next step is filtration and that may be performed in either gravity type or pressure type filters. The resultant effluent should be clear and contain not over the municipal tolerance of 0.3 ppm of iron. Usually it will be well below this; most effluents running 0.1 ppm or less and an occasional one 0.2 ppm.

Manganous bicarbonate may be removed by aeration, settling and filtration but a higher pH value is required for its oxidation (see Table 3) than is required in the oxidation of ferrous bicarbonate. However, unlike previously precipitated iron which has no catalytic effect, previously precipitated manganese has a pronounced catalytic effect so that complete oxidation may be effected at a pH of 8.5 or even slightly lower. Table 4 shows this catalytic effect. In this experiment, previously precipitated manganic hydroxide was stirred with the aerated water.

In practice, use is made of "ripened" filters, that is filters in which the sand has become coated with a very thin coating of manganic hydroxide. This serves as a contact medium to catalyze the oxidation of the manganous bicarbonate as the aerated water flows through the filters. One bad effect, though, is that the coatings gradually become thicker until finally they get so thick that particles flake off and contaminate the filtrate. The only way of overcoming this effect is periodic treatments of the filter beds to dissolve off these coatings.

While chlorine oxidizes ferrous bicarbonate at much lower pH values than air, chlorine does not have such a marked effect on the oxidation of manganous bicarbonate. This is clearly shown in Table 5 based on the oxidation by chlorine

of a water containing 10 ppm of manganese as manganous bicarbonate.

The equipment used for the removal of manganous bicarbonate by aeration, settling and filtration is the same as that used for removing ferrous bicarbonate. The alkaline material used to raise the pH value may be either lime or caustic soda. When properly carried out, the manganese in the effluent will be less than 0.1 ppm.

Aeration and Cold Lime Soda Process

Since many iron and manganese bearing municipal water supplies are also hard waters, the cold lime soda process is widely used for simultaneously removing the iron and/or manganese and softening the water. The removal is excellent for, at the relatively high pH values prevailing in the equipment, the oxidation to the insoluble hydroxides is rapidly effected.

The equipment employed consists of (a) aerator, (b) chemical feeders, (c) settling tank and (d) filters. The aerator — usually of the coke tray, wood slat tray or forced draft type—is generally mounted over the settling basin. Settling basins of the solids contact type, such as the Spaulding Precipitator, are favored for this purpose.

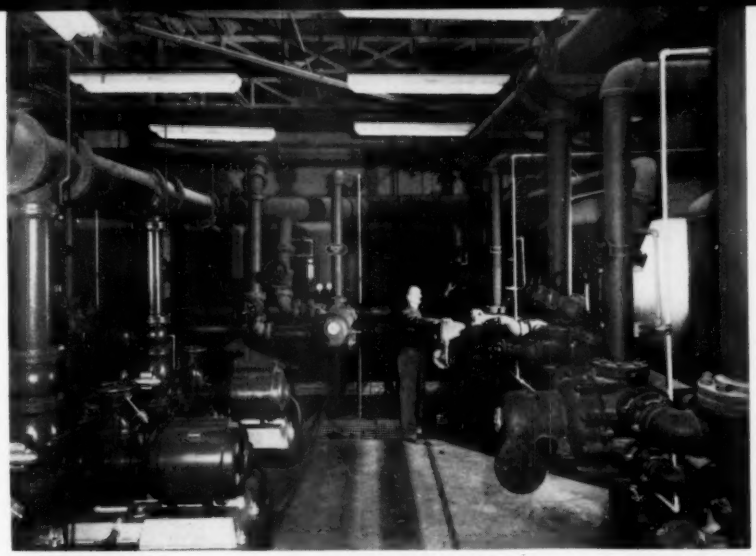
The chemical feeders are for feeding lime, soda ash (if necessary) and a coagulant, usually sulfate of alumina. From the settling tank, the settled water passes to the filters and from there, if of the usual gravity type, to the clearwell and to service.

If the amounts of iron present are large, it is often possible to eliminate the use of any other coagulant as the precipitated ferric hydroxide flocs the calcium carbonate and magnesium hydroxide precipitates forming a large and easily settled floc. As usually carried out, the hardness is reduced to 4 or 5 gpg, iron is reduced to 0.1 ppm and manganese to less than 0.1 ppm.

Zeolite (Sodium Cation Exchanger) Process

Iron and/or manganese, when present as the divalent bicarbonates, can be removed simultaneously with the hardness by passing the water through a zeolite (sodium cation exchanger) water softener. The cation exchangers used for this purpose may be of the synthetic resin, carbonaceous or greensand type.

Therefore, when a clear, deep well water is to be softened and also freed from iron and/or manganese, the zeolite water softener offers the simplest solution to the problem. With most of these waters, the removal is so complete that the iron or manganese content of the effluent will usually average 0.1 ppm or less. In fact, in many cases, zeolite water softeners have been installed primarily for iron or manganese removal, the water softening action being an incidental benefit.



● **PRESSURE filter battery, shown at the right in this picture, is used for filtering the aerated, neutralized and settled water at the Fairless Hills, Pa., plant.**

On regeneration with salt, the iron, which has been taken up by the zeolite on the softening run, is liberated as ferrous chloride. This, together with the calcium and magnesium chlorides, is thoroughly washed to the drain before returning the softener unit to service.

It is the usual practice to limit the application of the cation exchange process to waters having not more than 1 ppm of iron or manganese to each 2 gpg of hardness up to a maximum of not over 10 ppm. In other words, with a water containing 10 gpg of hardness, 5 ppm of iron or manganese would be the specified maximum, while with waters having 20 or more gpg of hardness, 10 ppm of iron or manganese would be the specified maximum.

It is possible to continue removing the iron and/or manganese even for some time after the end of the usual softening run. This property led to the so-called "salt starvation" process for softening iron and/or manganese bearing hard waters for municipal use where the hardness was to be reduced to 5 gpg. The softeners were usually arranged in batteries of 4 units and operations were so staggered that one unit would be on the overrun while the others were on the softening run.

As this method of operation does not yield a mixed effluent of unvarying hardness, it has largely

● **ORGANIC (chelated) iron and color removal plant at Newport, R. I. Color at times is as high as 60 ppm. Treatment is by coagulation, and gravity filtration.**

been superseded by two other methods. In the first, one portion of the water is passed through the softeners which remove both the hardness and the iron and/or manganese while another bypassed portion is treated only for the removal of the iron and/or manganese after which it is mixed with the softened water.

In the second method, all of the water is aerated, settled and filtered. Then one portion of the filtered water is softened and mixed with the requisite portion of the hard, filtered water.

Manganese Zeolite Process

The manganese zeolite process removes iron and/or manganese from water but does not soften it. This process is usually limited to waters which do not contain over 1 ppm of iron or manganese.

The removal is accomplished simply by filtering the water through the manganese zeolite which serves both to oxidize the iron or manganese to their insoluble forms and filter them out of the water. At intervals, these accumulations are removed by backwashing and before the oxidizing action is completely exhausted, the manganese zeolite bed is regenerated with a solution of potassium permanganate which restores its oxidizing power.

The capacity of manganese zeolite for either iron or manganese removal is 0.09 lb. per cu. ft. The amount of potassium permanganate required for regeneration is 0.18 lb. per cu. ft. The usual flow rate employed is 3 gpm per sq. ft. and the minimum backwash rate is 8 gpm per sq. ft.

Ferrous & Manganous Sulfates—Acid Waters—Ferrous and manganous sulfates are found only in acid waters. Such waters — both surface and ground waters—usually originate in mining districts and are mostly formed by the oxidation of marcasite—a type of iron pyrites. In addition to their content of ferrous and/or manganous sulfate, such waters often contain free sulfuric acid and may also contain appreciable amounts of aluminum sulfate.

The usual treatment is aeration; neutralization with lime, soda ash or caustic soda; settling; and filtration. Acid surface waters usually have a low free carbon dioxide content and may be aerated either before or after neutralization. Acid ground waters frequently contain very high amounts of free carbon dioxide and are best aerated before neutralization.

OPPORTUNITIES in CIVIL and PUBLIC WORKS ENGINEERING

THERE IS A great need today for more engineers. Civil and Sanitary engineering, in common with other branches of the profession, are faced with a shortage of capable men whose technical training and experience has fitted them for responsible positions. The American standard of living has placed great demands on the basic public works industry for better roads, more effective traffic control, increased water supplies and advanced methods for the disposal of municipal wastes. All of these programs require continual increments of men who are equipped with an engineering education.

To relieve this shortage in the future it is essential that young men planning their careers are fully acquainted with the advantages and opportunities that exist in the civil and public works engineering field. Accordingly, the Editor of PUBLIC WORKS has asked twelve leaders in various phases of the field to tell of the future that exists for young engineers in these professional areas.

In each of the reports which follow the author tells in general what the field embraces and describes the preparation, training and personal qualities that are desirable. The reader will learn how to get started in the field and how to progress. The important factors of varied experience and studies, where required, are discussed. Finally, an analysis is made of the rewards in service and in money.

Four articles appear in this issue; the other eight will be published in later issues. Reprints of each group of four articles will be available. In order to provide colleges with data which they may distribute to high schools, up to twenty copies of each reprint will be furnished without charge to any Professor of Civil Engineering on request. Larger quantities will be supplied at cost.

It is interesting to note that in many of these acid waters, especially the ground waters, part or even most of the iron may be present as ferrous bicarbonate. In many instances, this is due to the passage of the water through limestone bearing strata which neutralized all of the free sulfuric acid and some of the ferrous sulfate to form calcium sulfate, carbon dioxide and ferrous bicarbonate.

Some of these acid waters have such a high total content of sulfates that it is useless to attempt to treat them except for neutralization with lime. Others are amenable to treatment and this, as previously mentioned, usually consists of aeration, neutralization, settling and filtration. If softening also is required, the cold lime soda process is the one that is most widely used.

Organic (Chelated) Iron and Manganese—In many highly colored waters, iron and/or manganese may be present in an organic or chelated (key-lat-ed) form. Most of these are surface waters originating in swampy areas, but fairly shallow wells underlying peat beds and an occasional deep well may yield highly colored waters containing iron and/or manganese in this form.

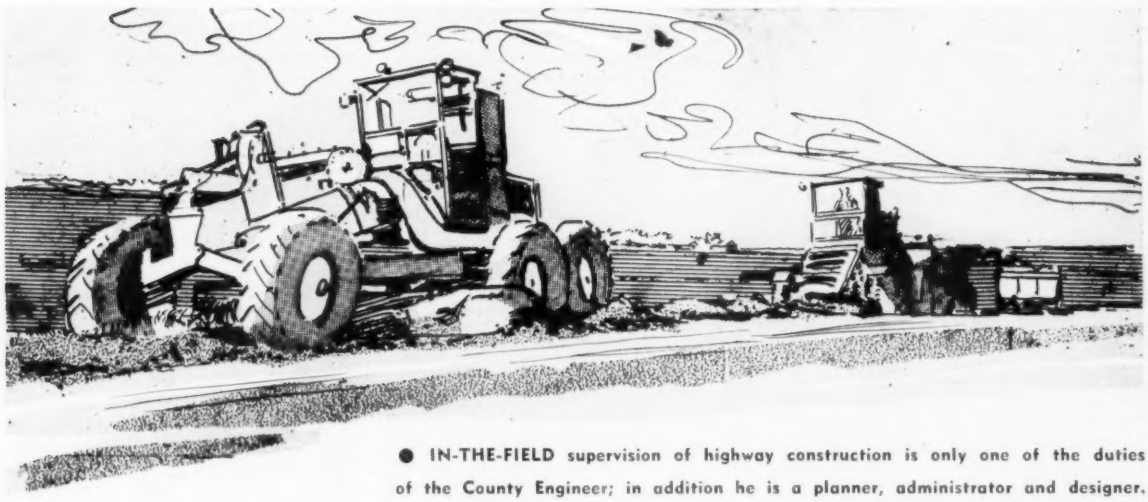
Iron and/or manganese in a chelated form are either not precipitated or only partially precipitated by aeration even when the pH is raised above 10.0, nor are they removed on passing the water through a zeolite softener. One well water with a color of 35 and an iron content of 3.5 ppm, had less than 1 ppm of its iron content removed by aeration, lime treatment, settling and filtration. Another, with both an extremely high color of 450 ppm and an iron content of 12 ppm, showed no removal of iron after aeration, treatment with lime and detention periods of up to 5 days. Passage through a zeolite water softener also had no effect on the iron content and chlorination, even with up to 50 ppm of chlorine, followed by filtration, removed only one-fourth of the iron content.

This is because the chelated iron or manganese does not ionize and therefore does not act like the divalent ions of these metals. Coagulation, settling and filtration, however, will usually remove the iron or manganese from such waters together with the color.

(*Continued on page* 183)

OPPORTUNITIES

In Civil and Public Works Engineering



● **IN-THE-FIELD** supervision of highway construction is only one of the duties of the County Engineer; in addition he is a planner, administrator and designer.

THE COUNTY ENGINEER

JAMES F. MEISNER

Marion County Engineer

Marion, Kansas

A COUNTY ENGINEER is comparable in experience to our old family doctor. He must be able to diagnose problems and solve them; to mingle and live with those he serves. In this he differs from other types of highway engineers. The state or federal departments will have their Chief Engineer of Planning, Surveys, Design, Construction, Maintenance, Traffic Control; a Business Administrator, Publicity Agent, Accountant, Right-of-Way Agent, Inspectors, Purchasing Agent and other specialists. The Highway Consulting Engineer will have specialists assigned to surveys, design, drafting, inspecting and the other various phases of his work. Only the County Engineer is privileged to imitate the family doctor and vary his experience by having the responsibility of all phases of highway engineering on his shoulders.

Rather than being a burden, it is a privilege; one can find no more fascinating engineering vocation than County Engineering. It is the County Engineer who has his professional arm around his county, sells his program to the Commissioners and the people; surveys, designs, inspects and builds; accepts, maintains, pays, keeps cost records, and in general heads the highway affairs of his county.

There is no better training for this interesting vocation than a Bachelor of Science Degree in Highway Civil Engineering from an accredited College of Engineering. Here the embryo County Engineer will learn the fundamentals of his profession, the principles of location and design. His engineering education will be rounded with introductory courses in other phases of living. He will learn to give and take with his fellowmen. In his fundamentals he will learn what is critical in design and what is incidental or ornamental and above all, he will learn where he might further pursue his education as new problems arise in his work.

Just as our old family doctor served in apprenticeship to learn the difference between theoretical and practical analysis and solution of the problem; just as he learned under the tutelage of an older, experienced doctor the difference between the theoretical curing of his patients after correct diagnosis and the practical application of the cure to the actions of an unpredictable patient, so the embryo County Engineer must learn under the tutelage of an older, experienced County Engineer. He must learn that there are several solutions to every county highway problem. For example: the shortest route is a straight line between two communities, but in county location, service to the individual is considered; ideal materials may be prohibitive in relation to the ability to use not so ideal local materials. In the apprenticeship step the embryo engineer must learn to recognize the difference between compromise of engineering principles and compromise for local expediency. He must learn the difference between compromise of engineering principles and divergent views between his nontechnical Commissioners and himself. He must realize that his employers may desire various types of construction not along his lines of thinking and differentiate between engineering principles and personal desires. Yes, the embryo engineer has as much to learn as an apprentice as he had when a student in the Engineering School. Here he must learn to co-

ordinate the theoretical with the practical; the ideal with the local conditions; the ideas of nontechnical employers with the ideas of a practicing engineer. The embryo County Engineer, from this apprenticeship, must emerge a practical man steeped in the theories of engineering and trained to solve his problems in a practical manner. He can never compromise with true engineering principles but he must always give full weight to local conditions, requirements and materials.

It is easy to see that the County Engineer has a personality of his own, different from all others. He must have a smooth temperament to carry him through the problem of convincing a patron that his demands are acknowledged, studied and executed, not to the patron's best personal interest, but to the best interest of the county as a whole. He must be a salesman to sell his program to the people as well as to his Commissioners. He must be observant not only of the physical conditions of the county but also of the mental attitude of the people, for most anticipated problems are easier to solve than those that sneak up unawares.

Personally, I think he should be a good Christian home-owning family man who is willing to call his county his home county. This means that he will take part in local civic activities. He will be as interested in the economics of his department as any other taxpayer. He should be friendly and willing to listen to all of his people's highway problems and make an honest effort to satisfy and solve all honest problems.

Yes, the County Engineer must be a good public relations man, for there is no business that has as many "experts" as the highway business and it is the responsibility of the County Engineer to place himself above these experts and still remain their friend.

To me there is only one way to acquire the status of County Engineer, and that is no different than in any other profession or business. First, qualify yourself technically; second, receive practical training; and finally, jump off the deep end and accept the responsibility for your own ideas and actions.

Probably the best employment agency for county engineering positions would be the State Highway Department. They should know of the vacancies within the counties. In Kansas, the County Commissioners are the proper authority for the employment of County Engineers, even though the state law requires the approval of the State Highway Department as to the Engineer's qualifications. In actual practice, the state approval covers only the technical qualifications of the Engineer, leaving such factors as personality, experience and other individual qualifications to the counties.

Once an engineer is established as County Engineer, he will find that he has a life of varied experiences before him. To the people in rural counties, such as in Kansas, he is their contact with the technical world. They will seek his opinion on how best to construct any of the multitude of structures on the average farm. For his Commissioners he will be expected to translate their ideas into an integrated county highway system; and for the general public he will, in a large measure, be "Mr. Engineer", the model by which the engineering profession is judged.

The County Engineer holds this peculiar situation because he works in the very grass roots of engineering. He is the first contact of most people with engineers and the last contact of many, and for this reason he holds one of the most important posts in engineering. He is the profession's ambassador among the rank and file of people, and on his shoulders rests the good will of the engineering profession as a whole within his county.

Just what are the rewards for such a service to mankind? That depends, of course, on the individual engineer. Just what reward does he seek? Many professions award their members more in wordly goods, but few make greater awards in personal satisfaction.

One has only to read our newspapers to realize that happiness and contentment are not attributes of wealth nor fame; they are more the attributes of a worthwhile Christian job well done with reasonable compensation for one's services. They come from an inner personal satisfaction that one is accomplishing a job to the satisfaction and betterment of mankind.

This does not mean that the position of County Engineer is one of austerity, for a survey of the income of County Engineers shows that the financial return is, on the average, equal to or above the average of the professions within the community. Also, there has been a definite upswing in prestige in the profession of county engineering, which will certainly continue as qualifications for County Engineers are strengthened. This, in turn, will strengthen their financial return.

There is a reward in the county engineering profession that is greater than excessive earnings. While the profession is political in nature, it is fast losing the stigma of politics —that is, the political qualifications for holding any one position. My own tenure of 24 years in one office can be excelled by several other Kansas County Engineers. My acquaintance with engineers in other states, through our American Road Builders Association contacts, leads me to believe other states have engineers with similar and better tenures. This, in turn, means that the County Engineer can assume his rightful place in society and that this department of Civil Engineering is gaining stability of location. It means he can take part in local civic and social activities. His children can be educated within one system of schools. It means he can serve on the School Board and have a say in his children's education. He can serve as civic or municipal officer; he can plant his feet squarely on the ground and use his talents and skills to build up the community in which he will live and raise his family.

Yes, county engineering, as a profession, is rapidly becoming a reality and the County Engineer is rapidly becoming one of the leaders of his community. It is truly a noble profession for a Civil Engineer who wants to live in one community and be respected in the grass roots area of his profession.

James F. Meisner, born on a farm in Kansas, is a civil engineering graduate of the University of Kansas. After graduation, he spent four years with the Illinois State Highway Department and with Douglas Co., Kansas, before becoming County Engineer of Marion County in 1931. Except for a short interim period, he has held the position ever since. Thus, he speaks with the authority of long experience when he tells of the duties, the responsibilities and the rewards in County Engineering. Listed in "Who's Who in Engineering," he has been active in civic and religious organizations as well. He is a Registered Professional Engineer and a member of the American Road Builders' Association, the Kansas County Engineers Association, the Kansas Engineering Society and the American Congress of Surveying.

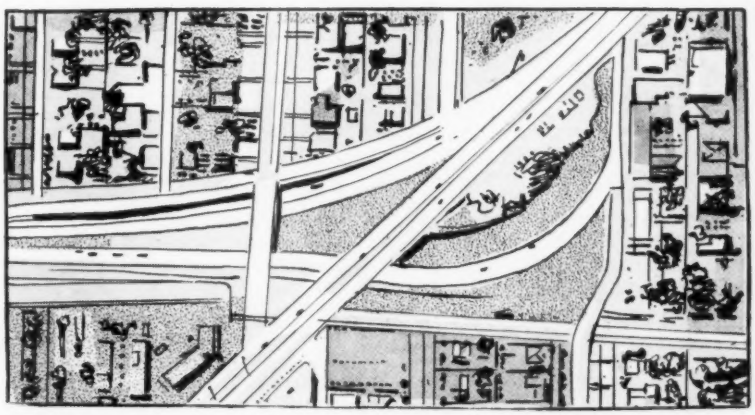
OPPORTUNITIES

In Civil and Public Works Engineering

MAX STURM

City Engineer and Director of Public Works

Sarasota, Florida



● **SOUND engineering training, plus ability to get things done, are essential elements in being a good city engineer. This is a growing field of much opportunity.**

THE CITY ENGINEER

THE SCOPE of this field can be summarized by stating that it involves the construction and maintenance of structures and facilities which are paid for and used by the public. Usually this is done without any monetary profit motive. Examples are roads, bridges, public buildings, utilities systems, maintenance, traffic control and waste collection and disposal.

Preparation and training for this work may be said to start in childhood in learning how to get along well with others, learning to respect others' rights and ideas and learning to be a good listener. The author feels that few, if any, courses surpass engineering training for development of the thinking processes of the mind. The mental machinery needed in solving the many types of engineering problems is exactly the same as is needed in management, human relations and domestic problems.

There is probably some basis for the frequent accusation that engineering training is "too narrow in scope." Educators realize this to be the case but must make a compromise to cover in four years what should preferably require five or even six years of college training. Desirable studies frequently neglected include: administration, public speaking, accounting, business law and government. The student will find typing and shorthand useful. It is suggested that somewhere a course such as "How to Win Friends and Influence People" would prove beneficial. It is also felt that more engineering students need undergraduate working experience in the engineering field. This stimulates a real interest in the engineering profession and gives a keener understanding of the need for technical training.

Personal qualities that are desirable include good health, initiative, drive, leadership, fairness, judgement and experience—to name a few. Perhaps they can be summarized in the term "Ability to Get Things Done." Superiors are quick to recognize this quality in an employee but it must combine a number of good personal characteristics with emphasis on the ability properly to utilize the personnel in his organization. No man can accomplish much alone. In the public works organization will be found all types of labor from common to skilled to professional. Maximum utilization of such a heterogeneous organization is a duty and a challenge to all Public Works Engineers.

We have already called attention to the need for ability to get along well with others. This applies upward and inward as well as downward and outward in an organization. One must learn to accept orders from higher levels and to give full cooperation in the execution of such orders. Loyalty is absolutely necessary if friction is to be avoided. This does not mean one must always be a "Yes" man; on the contrary most superiors welcome expression of sound conflicting opinions or good ideas so long as authority is not questioned.

Subordinates rightfully look to their boss for improvement in their personal welfare. Your men must feel that you have their interests at heart or they will not do their best work. *Esprit de corps* is important. Meritorious service and ability must be recognized and rewarded. Whenever possible incentives must be created to encourage production throughout the organization. An example of this used by the author is a by-monthly report from the foremen summarizing their activities. This report is forwarded to the City Manager who often shows it to the City Commission. This not only keeps the manager and commission informed but also gives the foremen a chance to have performance recognized, thereby creating incentive.

Getting started in the field is relatively easy now. In these days of shortage of engineers, the problem is not where to look for work but which job to choose. To get started it is suggested that prospective public works engineers look for opportunities to work with city, county, state and other engineering organizations during summer months and whenever not in school. In this way one can get valuable experience and can also make contacts which may lead to permanent employment or at least references for recommendation.

Opportunities for employment in the public works field are listed in

many periodicals and although this field is very broad in scope, it is usually necessary to start in a specialized capacity such as surveyor, draftsman, chemist, administrative assistant or work of similar scope. Once established in an organization, however, one should learn as much as possible of the operations outside of one's specialty, and to take on additional tasks and responsibilities, since advancement will be proportional to responsibility.

Progress in this field can be quite rapid. Opportunities are great. There is an enormous backlog of public improvements which need the services of public works engineers in planning, construction and operation phases. Public works operation in government is beyond question gaining rapidly in efficiency but there is still a great need for better personnel and equipment management. Many counties and small to medium sized cities are for the first time realizing the value and economic necessity for competent engineers.

"There is always room at the top" certainly applies to this field of engineering but the author feels that many engineers limit their progress by confining their interests to a relatively narrow field. Thus one whose early training is in sanitary engineering has a temptation to concentrate his energies on water and sewage treatment and an electrical engineer may find himself devoting most of his time on power plant operations at the expense of other public works operations. Engineers in top echelon positions must be able to see the entire field in true perspective. Inability to assess each activity at its proper value has limited the progress of many public works engineers. We must intelligently scrutinize each department to improve individual operation. This requires a certain amount of technical knowledge which must be gained through study and experience. Valuable references for broadening one's outlook will be found in this magazine, PUBLIC WORKS; the International City Managers Association course "Public Works Administration"; and publications from the American Public Works Association, to mention a few.

With the exception of a relatively few specialists in large organizations the top positions in public works departments are mainly administrative in nature. We have stated before that one man can accomplish very little by himself. It should also be noted, however, that the man in the top position can certainly be the chief bottle-neck to effective production. If he fails in his role of "Quarterback" or "Detonator" he can block the chain reaction from occurring. Thus, while most public works engineers will probably admit (modestly, of course) that they are a "Jack of all trades", they will also admit that to survive they must be a good administrator or expediter.

It is necessary to have general policies (approved by the manager or mayor) for levels of service possible within the budget limitations. Such policies must be logical and the same for everybody. For example, we have many more requests for street lights than we have been able to approve, but each request is surveyed and scientifically scored on a prepared form to determine the relative need for the light. The requester is then informed of the findings.

Our city manager recently made the statement that his job was to develop people and this applies also to public works engineers. Delegation of responsibilities and decisions to others in the organization is necessary for production and for development of initiative. We like very much the rule adopted by one of the president's chief advisors, Sherman Adams, in which he decrees that none in his organization may offer criticism without an accompanying suggested solution.

How to get along in this field depends a great deal on the size of the organization. Experience of the writer has been limited to relatively small cities. It is believed, however, that the same general principles apply to larger organizations in public works.

Rewards in Service and Money

Few will deny that industry is far ahead of government in operational efficiency. Politics has unquestionably had a leading part in this condition. There has also been a reluctance on the part of government to pay salaries high enough to attract top men. In the past twenty-five years, however, there has been a trend toward the city and county manager form of government which has been accompanied by higher efficiencies and employment of more competent and better trained public works engineers. Thus it appears that the field is unsaturated and that salaries are increasingly attractive. The opportunities are great.

The annual salaries paid Directors of Public Works are quoted from the 1955 Municipal Year Book. City Engineers receive approximately the same salaries.

The men with technical training and good experience will generally

Max Sturm received a BS in Chemical Engineering from the University of Oklahoma in 1935, and soon after went to work as assistant city engineer and chemist for Winfield, Kansas, a city which owns all of its utilities including water, sewerage, electric power and natural gas systems. He became city engineer after two and one half years, later assuming the additional duties of superintendent of sewage treatment and wastes disposal. He remained in this position until 1941 when he left to become a civilian engineer with the Army, serving in Alabama and Florida in Post Utility operations and in general civil engineering. Later service with the Army in the grades of Lieutenant and Captain included duties as Military Government officer in charge of utilities at Inchon, Korea, the port of debarkation for U. S. Armed Forces in Korea. Following separation from the Army he spent four years as Regional Sanitary Engineer with the Florida State Board of Health, and in 1951 became City Engineer and Director of Public Works for Sarasota, Florida. This city has grown from a population of 10,000 to 30,000 in the last 20 years—a situation which provides a great need for public works engineering.

ANNUAL SALARIES OF DIRECTORS OF PUBLIC WORKS

Population Range	*Mean*	*Lowest*	*Highest*
10,000 to 25,000	$ 6,143	$ 3,380	$ 11,750
25,000 to 50,000	7,064	3,480	12,000
50,000 to 100,000	8,227	4,500	12,000
100,000 to 250,000	8,784	4,500	12,298
250,000 to 500,000	10,843	7,200	15,000
Over 500,000	14,516	10,000	18,000

be in the salary range between the mean and the highest figures shown.

Practically all governmental employees now enjoy other benefits such as hospitalization and insurance policies, civil service, or pension plans and social security, all of which offer security and protection in case of misfortune and for old age.

More and more engineers are being chosen for executive and managerial positions. Experience gained in the field of public works is broad and many opportunities present themselves. Association with other successful people and public leaders is frequent and often fruitful. Many public works engineers later go into business for themselves in consulting engineering, the contracting business, sales engineering or other fields.

There are many, however, who remain in public works engineering because of a feeling of satisfaction and enjoyment in seeing progress and accomplishment of dreams and plans in which they have had a close and personal contribution. Public service makes a person feel that he "belongs" in a community and wants to "take roots and grow" with the community. The author has found his work interesting, even fascinating, and without hesitation recommends to the prospective student this phase of the field of Civil and Public Works Engineering.

OPPORTUNITIES

In Civil and Public Works Engineering

C. A. HARRELL

City Manager

Cincinnati, Ohio

● **HIGHEST TYPES of engineering and administrative skills are required for the many activities of the City Manager in the direction of modern municipal operations.**

THE CITY MANAGER

THE COUNCIL-MANAGER plan of government, which in municipal government calls for a City Council with a City Manager, was born in 1908. Since then it has had a very remarkable growth. Within a mere generation it has become an internationally accepted scheme of municipal government with the result that today, in the United States alone, 28 million people live with and are served by the plan.

The city manager profession is still therefore one of the newest in the world today. Less than 20 years ago there were 350 governmental units with this system. As of January 1, 1955, there were 1,275.

The City Manager's Duties: Although city charters ordinarily set forth in detail the duties of the city manager, they may be stated in these general terms:

1. He sees that all laws and city ordinances are enforced.
2. He controls all city departments and appoints, supervises and removes department heads and other employees of the city.
3. He makes such recommendations to the Council concerning the affairs of the city as may seem to him desirable.
4. He prepares for the Council such reports as that body may require or request.
5. He keeps the Council advised of the current financial condition and future needs of the city.
6. He makes up the budget each year and after its adoption by Council is responsible for its effective administration.
7. He keeps the public informed regarding the operations and progress.

These are the duties in cold print, but the qualities and abilities required go much deeper.

Beginning as a relatively anonymous administrator the manager today, although his fundamental duties remain, finds himself more and more closely associated with policy formation. He has broadened his horizons because the emerging social and economic problems of the passing years have required him to do so.

The role of the City Manager in determining municipal policies and placing them before the public has changed considerably during the years and will continue to change. The concept of the Manager today as a community leader is a major departure from the original theory of council-manager government.

It is my growing conviction based on experience that the city mana-

ger owes it to his community to exercise more imagination and vision in his policy proposals for action by the Council.

He has the best interests of his city at heart. That is his job and that is what he works for. He must broaden his concept of managerial duties and not wait for the Council or even the citizens to propose actions which he believes the Council should consider. Perhaps I can express my idea by saying that in his thinking he should be one step or many steps ahead of the thinking of Council, special groups and the citizens.

It is now amply demonstrated that city management lends itself to formal training. The most appropriate educational background appears to be a broad liberal arts orientation, followed by graduate training in public administration which emphasizes the underlying principles and objectives of local government and its component programs, case studies of actual situations, and field interneships. At present only about 8 percent of the city managers have this type of educational background now considered most desirable. But it should not be forgotten that the development of a formalized educational process started from zero only a relatively few years ago.

Forty years ago the first city managers found little or no academic training available. Today dozens of colleges and universities offer graduate courses in public administration, and a few offer excellent graduate training directed specifically to the city manager profession. More and more young people are selecting it as their chosen career.

The emphasis in those earlier days was on civil engineering and public works. Today it is safe to say that the typical city manager devotes much of his time and energies to the broader aspects of administration, however important engineering may still be. My own background is that of a civil engineer and I would be the last to move it far from the head of the list.

The most important single qualification for a city manager is management ability. Today it is not primarily an engineering or a financial position but rather a top management job. There is a management job to be done in the area of every local governmental unit and that job belongs to the manager.

As chief administrator of all departments placed under his control he needs certain definite abilities. His problems are usually complex. In making an administrative decision he must have a high order of intelligence to see them clearly.

He must build and maintain an organization, welding the individuals of his staff into an effective unit. To accomplish this he must be a good judge of personality and competence, and must inspire the respect and support of his subordinates He must have the confidence of the public, never attempting to dictate public policies or urge his own views in opposition to those of the people's elected representative. Above all, he must do more than merely maintain a receptive mind. He must be an active force in developing new ideas and procedures.

In addition to university degrees, or even long municipal experience, he must show honesty, forcefulness, tact, industry, vision, a sense of humor, loyalty to the interests of his city as a whole, refusal to play politics or give advice inconsistent with his own best judgment or the permanent interests of his city.

In hiring a city manager, City Councils today consider not only whether or not the candidate has a college or university training, but whether or not he has also any college, university or other formal training in municipal administration. Such training is therefore exceedingly valuable.

A graduate course gives prospective city managers a broad training in the social sciences and an acquaintance with the principal problems which municipalities of all sizes must increasingly face. Experience on the staff of a well-equipped governmental research agency may afford training of equal value.

A young man with this background may make a good city manager for a small city or an assistant to the city manager of a large city. Some of the very successful city managers entered the profession through these doors. The trend for some years has been toward the appointment of men with public administration training plus experience. An increasing number of cities are taking these graduates as "internes" and as administrative assistants to the city managers. After a few years they become city managers.

Cities of 10,000 or less today look for men who have pursued graduate work in public administration and who have had some active experience either as a departmental aide or as an assistant to a city manager.

Probably the greatest need among the city managers of today and surely those of tomorrow is for additional study to be given to the complex field of human relations, and to the basic goals of government. The modern city manager does not deal so much in terms of things as he does in terms of human relationships, needs and requirements. His professional education throughout life should be geared to assist him with this all-important aspect of his work. His ultimate technical equipment should cover a wide range of human knowledge with a sound foundation in history, economics, sociology, and government. He should be no stranger to individual and group psychology, politics, ethics and logic. The activities of political parties and pressure groups should be familiar to him. He should know how private business is organized and conducted, its strengths and weaknesses.

He will find it necessary to learn the basic principles underlying public activities such as health, welfare, public works and law enforcement, since he must judge the competence of his assistants in those fields and be able to discuss their technical problems intelligently with them.

C. A. Harrell, City Manager of Cincinnati, Ohio, writes from long experience and fine educational background. His degrees include AB and LLD, the latter honorary, from Randolph Macon College; MA from Columbia University; CE from University of Cincinnati; and MS in Public Administration from Syracuse University. His experience has been broad; three years of pre-management work fitted him to become executive assistant to the City Manager of Cincinnati some twenty-seven years ago. Since that time he has been one of our most successful City Managers, with service in Portsmouth, Ohio, Binghamton and Schenectady, N. Y., Norfolk, Va., and San Antonio, Texas. His many accomplishments are listed in "Who's Who in America." He is a member of the American Society of Civil Engineers, the American Society of Planning Officials, the National Municipal League, the International City Managers' Association, the American Society for Public Administration, the Governmental Research Association and the American Economic Association.

Today's city manager is professionally-minded, which means devotion to a high ethical code of conduct, a deep sense of social responsibility, a sound understanding of government objectives, a firm belief in the worth of government services and a determination to shun politics.

The profession has developed greatly since I entered it, and it will continue to develop, not in a fixed pattern, or even a foreseeable one, but in accordance with the peculiar demands of the changing, dynamic society in which we live.

Probably no harm can come to the aspirant for city management laurels if he will look into the, let us say, crass matter of salaries paid city managers. To do this he may consult the Municipal Year Book for 1955, published by the International City Managers Association. It is generally on file in public and municipal libraries and contains the latest information on salaries of city managers and other municipal officers.

With interest among young people growing with each passing year, there is every reason for optimism concerning the future of the profession. As stated before there are today in the United States 1,275 cities operating under the council-manager plan. What may be equally significant to the future of the profession is that there remain 1,700 cities of more than 5,000 population who have not up to this time adopted this form of government; but many of them are now considering it.

An increasing volume of knowledge on city government and the art of administration is rapidly becoming available. In many respects there are now better educational materials on local government than on the State or Federal level.

The many changes which have been wrought since the birth of city management are basically good for American communities. The entire level of local government endeavor has been substantially raised by the growing influence of the professional manager.

Those who have participated have found it a great inner satisfaction to be a part of that movement.

OPPORTUNITIES

In Civil and Public Works Engineering

● **EXPANDING highway needs for many years to come will necessitate construction of thousands of miles of modern roads, involving many complicated structures.**

THE STATE HIGHWAY ENGINEER

REX M. WHITTON

Chief Engineer

Missouri State Highway Commission

Jefferson City, Missouri

ONE OF THE most important persons in this country today is the young engineer who has potential. That young engineer can develop his potential primarily through application of basic engineering training. To get the most out of that training he must be in a field offering broad vision and opportunity for unlimited advancement. State highway engineering stands today in the forefront of such fields.

Compare an Organization Chart of a typical State Highway Department of thirty years ago with a like Chart for today. All of the old positions are there. So are scores of new ones, added as a result of the unprecedented increase of motor vehicles and their use. Highway problems certainly have multiplied. The building and maintaining of highways, including all ramifications thereof will, without a doubt, be America's great task for generations to come.

The problem of building and maintaining highways is the responsibility of government. The greater part of this responsibility becomes a function of the various states and their Highway Departments. Ever since State Highway Departments have assumed these responsibilities there has been an ever increasing demand for technically trained persons in the field of Highway Engineering. Well trained and competent engineers, with imagination and full appreciation of the complexities that face them, will find that opportunities provided by State Highway Departments for developing their potentials are unlimited, due to the very nature of the expanding problem.

It has been stated that State Highway Departments have been fruitful training grounds for Civil Engineers to expand to other industry. Let the past be what it may. That certainly is not the condition in the present age of highway transportation development. Experience of recent years in the field of Highway Engineering indicates that the young Civil Engineer has greater opportunities in a Highway Department to advance to positions in engineering management than he does in private industry.

The young Civil Engineer who desires to specialize technically, will find varied opportunities in the field of Highway Engineering as practiced by State Highway Departments. Those with a liking for the outdoors may specialize in surveying, construction inspection and supervision, or in highway maintenance, which may be classed as a field in itself. Highway surveying provides the opportunity for both land and route surveying. Construction furnishes the opportunity of self expansion in the production of tangible products as roadways and structures. Maintenance permits the use of ingenuity in developing methods, procedures, and in some instances equipment used in maintaining roadways and bridges.

The individual with the creative mind may find satisfaction in the expression of basic engineering principles applied in new forms to the design of multiple lane expressways or to the beauty and practicability of concrete and steel structures.

There is also the opportunity for a person with an inquisitive nature and mind in the field of materials and research, and their application to improved methods of design and construction of roadways and structures. Here the field is unlimited, because much is yet to be learned concerning highway construction materials and their use that will pace the rapid development of rubber borne transportation.

In each of the above fields and with the majority of the State Highway Departments, an individual may experience the satisfaction of possessing security of employment in his profession. Each year sees a steady change from the old philosophy of political highway departments to departments operating on a basis of merit and sound business practices. This definitely affords the opportunity for a professional career of long duration in the highway field without influence or interruption from outside forces.

The majority of the State Highway Departments furnish the leadership found in technical and professional organizations on the state and national level as well as the leaders in the various communities where these individuals reside. Professional recognition is important not only to the individual Engineer but also to the organization which employs him and with which he is readily identified.

Not too many years past positions of employment in governmental agencies were identified with mediocre salaries and, in many instances, with low salaries. In fact, they often were the lowest in the engineering profession. It is now found that State Highway Departments have practically lifted themselves from this category by their own bootstraps. Today salary schedules of the majority of the Departments are found to be comparable with and, in some instances, to exceed those of private industry.

Yes, it would be well for the young Engineer just graduating from a technical college to investigate thoroughly the field of Highway Engineering as practiced by State Highway Departments. There he will find a life-time career offering security in employment, an equitable salary, opportunities for advancement, professional recognition, and last, but not least, a feeling of happiness and satisfaction in the knowledge that he is living up to the basic creed of the Engineer, "To serve mankind and society by properly applying the laws of nature in order to make this a better world in which to live."

Rex M. Whitton graduated with a Civil Engineering degree from the University of Missouri and started with the State Highway Department as a member of a survey party. After two years he was assistant resident engineer; then followed promotions to resident engineer; chief of survey party and plans designer; assistant district engineer in charge of survey; and then to assistant in charge of construction. He won the position as engineer of special assignments on a state-wide basis after seven years of service. Promotion to district engineer and to engineer of maintenance for the entire state followed; and in 1951 he was made Chief Engineer of the State Highway Commission. He has received recognition from many sources for his leadership in engineering, including the Missouri Honor Award for Distinguished Service in Engineering. He has always been active in civic and religious affairs. He is a member of the American Society of Civil Engineers, is president of the American Association of State Highway Engineers and a member of the Executive Committee of the Highway Research Board.

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Developing a More Useful Airport

To combat the growing hazards of metal and other heavy objects on airstrips and runways, the Air Force is planning development of a new kind of sweeper. The contract for research and development has been awarded to Wayne Manufacturing Company of Pomona, California, and work is expected to be completed in about six months. The need for a sweeper which will pick up heavy objects is urgent. A ten-cent bolt, scooped up in the engine of a jet, can wreck or seriously damage a multi-million dollar modern jet fighter. The new sweeper will operate without brushes or brooms which have always been found on mechanical sweepers in the past. It will sweep at speeds not previously considered possible, since speed is a requirement for a satisfactory air base sweeper.

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Attendance High at Municipal Swimming Pool

During its first season of service, the municipal swimming pool at Redwood Falls, Minnesota, 1950 pop. 3813, had a total attendance of 38,032.

TRICKLING FILTER DESIGN LOADINGS

J. A. MONTGOMERY

Lakeside Engineering Corp.,

Chicago, Illinois

UNTIL SOME 25 years ago, all trickling filters were of the low-rate or, so-called, conventional type. The loading on the filters was rarely over 400 lbs. of BOD per acre-foot, or 0.25 lb. per cu. yd. of media. These were sturdy units and, when not overloaded, produced quite satisfactory results. However, they had their troubles, such as filter flies and ponding. In cold climates, they required protection.

In the early 1930s, two bacteriologists developed means of reducing the cost of the conventional filter by increasing the load and employing recirculation. The idea was to operate the filters continuously, 24 hours per day, without the rest periods then employed. These men found that the loading on the filter could be greatly increased with continuous operation, using recirculation as a means of maintaining a continual flow to the filter.

One of these men was Prof. Max Levine of the University of Iowa who developed continuous operation by recirculating normally from the effluent of the filter back through the primary clarifier, as is now used in Bio-filter installations.

While Prof. Levine was doing his work at Ames, and at the Decker Packing Company's plant in Mason City, Iowa, Dr. H. O. Halvorson, a Bacteriologist at the University of Minnesota, was also carrying on studies of trickling filters. Halvorson's theory was that he could greatly increase the efficiency of the filter by covering a greater percentage of the filter momentarily, thus reducing the momentary load per square foot of filter surface. In other words, through the use of a distributor with a greater number of arms in conjunction with the centrifugal nozzles to break the sewage up into a raindrop form, or by using a rotating disc, Halvorson developed the Aero-filter. Although the Aero-filter did not make a claim for recirculation as such, Halvorson used it in order to maintain the continuous flow to the filter.

About the same time Mr. Shook of Dayton, Ohio, applied for and obtained a patent on a high-rate filter, using, as his basis, recirculation of filter effluent directly back to the column of the distributor.

Thus there were three different persons who had an important part in bringing about the modern high rate filter. It is certainly true that many high rate filter installations have been headaches, chiefly because they were everloaded, and it took a good many installations before we were able to learn about good design. One of the difficulties in the development of sewage treatment is the length of time it takes to learn actual facts about new processes.

Design for Loading

Originally most high-rate filter plants were designed on an applied load (settled sewage basis) of 3000 lbs. per acre-foot or more. We, who were promoting the Aero-filter, soon learned that such a load is excessive. The filter would take the load all right but the plant effluent was not satisfactory for a dry ditch discharge. Even as late as World War II, there were high-rate filter plants built, based on 3000 lbs. per acre-foot of filter rock. The Aero-filter dropped its recommended load to 2400 lbs. per acre-foot and even at that load one cannot obtain satisfactory results for a dry run discharge, unless sufficient recirculation is used to maintain 30 ppm of BOD, or less, in the plant effluent.

Today many states permit the use of high rate filters for a discharge into a dry run. Some states use lower loadings than 2400 lbs. per acre-foot; some require an extra amount of recirculation; and some require two-stage plants for a dry run discharge.

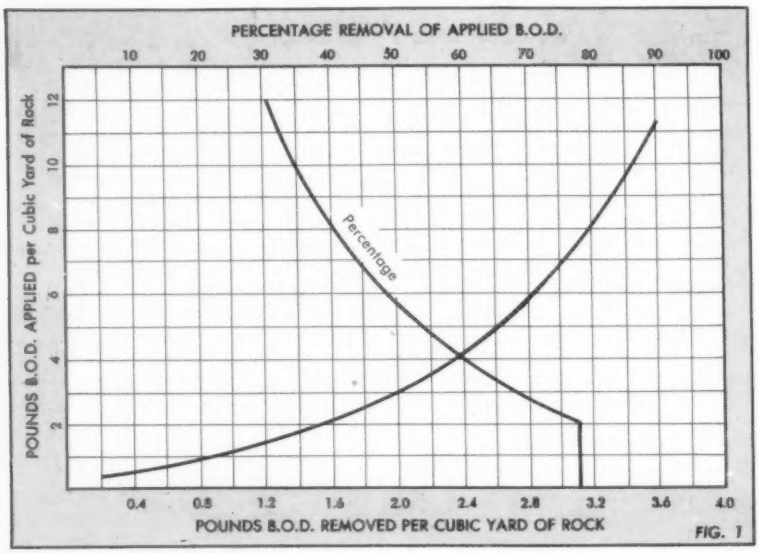
Single stage high rate filter operation will give results highly satisfactory for a dry run discharge, provided the load to the filter is not excessive and provided the BOD in the final effluent is kept low by means of recirculation.

Most high rate filter plants today are designed on the basis of an ap-

● **TRICKLING filter of this type utilizes a number of arms on distributor for reducing momentary loads. Loading may be as high as 2,400 lbs. BOD per AF.**

plied load to the filter, or filters, (settled sewage basis, exclusive of recirculation) of 2000 lbs. of BOD per acre-foot, (1.25 lbs. per cu. yd.) or more of filter media. In actual operation, however, the loadings often have been in the so-called twilight zone, namely, 400 to 1600 lbs. of BOD per acre foot. These plants have normally functioned better opportunity for the growth of nitrifying organisms in the bottom of the 8-ft. filter. Therefore, the 8-ft. filter should produce a more stable effluent. In Germany there are a number of filters that have been built 10 to 14 ft. deep.

For strong sewages, two-stage operation should be used. On the basis of an equal amount of filter media



● **LOADING CURVE for high rate trickling filters, showing BOD removal per cubic yard of rock and removal percentage. Note: BOD applied is on settled sewage basis.**

without operating difficulty. The old style conventional filter is usually the most expensive unit in a trickling filter type sewage plant. It is our belief that highly satisfactory plant results can be obtained for a dry run discharge by using filter loadings, settled sewage basis, of 800 to 2000 lbs. per acre-foot, provided that 6 to 8-ft. filter depths are used; and provided further that sufficient recirculation is used through the filter to maintain a 30 ppm of BOD, or less, in the plant effluent in order to produce a satisfactory degree of nitrification.

There are those who believe that nothing is gained by using a filter depth of more than 6 ft., but this writer is not of that opinion. It is not a case of 6 or 8-ft. depth, using a third more rock in the 8-ft. than in the 6-ft. depth, but rather a case of deciding whether to use a given number of yards of filter media in a 6-ft. filter, or to use the same amount of filter material in an 8-ft. filter with a less diameter than that of the 6-ft. depth. It is our opinion that the BOD removal will be approximately the same in both cases; but we believe that there is a much in two-plants, a two-stage installation will provide better results than a single stage installation.

Aside from the much lower cost of high rate filters over conventional filters, the high rate filters have additional advantages in that, although they have filter flies, a filter fly does not come out in the rain; so we keep it raining on every radius of the filter. The high-rate filter in northern climates will rarely have to be shut down in the winter months, if it is properly designed and operated. High-rate filter media should be large, perhaps 2½ to 4-inch in diameter, and if it is rescreened on the job before it is placed in the filter, ponding will normally not be a problem.

Operating Results

Now that we have the high rate filter operating, how can we know that it is doing its maximum job? Prior to and during the war the author spent considerable time and money checking the results produced by high-rate filters in various sections of the country. From these results a loading curve was drawn, the original of which was published in *Sewage Works Engineering*, November, 1942, under the title: "Aero-filter Results, Predictions and Performances". In 1946, a series of three papers by this writer was published along the same line in the January, March and May issues of *Water and Sewage Works*. Why did we use Aero-filter plants for the tests? First, because we were particularly interested in Aero-filters, and secondly, Aero-filter plants did not recirculate through the primary clarifier except to return final tank sludge; hence we could fairly well determine the applied load to the filter on the basis of raw settled sewage.

Fig. 1 is the original curve. Some 640 analyses on eight different plants were used to plot the curve. We did not pick the plants at random, because we were trying to determine *what could be accomplished* by a properly built and properly operated plant, with a competent man in charge to make the analysis in each plant. The writer did not run a single analysis, but merely took the work of men whom he knew to be competent to make the tests. Furthermore, no data was cast out because it did not work in with other data. All data that we had was used in obtaining the monthly averages, winter or summer. We believe that the curve is the most accurate ever made on such a wide range of loadings.

In Fig. 2 we have shown the same curve without any of the original points, but with data subsequently collected from other well operated plants after the original curve was made.

The "A" points of Fig. 2 show summer results for two 30-ft. diameter high rate Aero-filters, 8 ft. deep, operating in parallel. The removal by these same filters in winter months does not correspond to this curve because of the return of a very bad supernatant from an unheated digester. "B" results are for a 6-ft. depth conventional filter, operating in parallel with an 8-ft. depth high rate Aero-filter. The average results represented by the "C" point, were recorded by another investigator on a 6-ft. depth Aero-filter, using a motor driven disc distributor.

The "D" results were reported by Levine in a paper which he gave at College Station, Texas, on his first stage Bio-filter at the Decker Packing Plant, Mason City, Iowa. The "E-1" results were obtained from two 30-ft. diameter filters operating in parallel at Ft. Crook, Omaha, both winter and summer and when a great deal of mineral oil passed the skimmer of the rectangular clarifier and coated the active organisms on

the filter rock. The "E" results were obtained from the same two filters after most of the mineral oil was removed from the sewage. Cold weather did not adversely affect the filter efficiency, since the "E" results were also for winter and summer operation. The "F" results were determined by the United States Public Health Service, working in conjunction with a State Board of Health, on an Aero-filter plant in Missouri which had loadings of less than 2 lbs. per cu. yd. of rock.

The average results represented by point "G" show the greatest efficiency of any Aero-filter ever built, using a rock media. This filter is 30 ft. in diameter and 9 ft. deep—the deepest Aero-filter ever installed. The filter loading is approximately 3.5 lbs. of BOD per cu. yd. of rock, and the removal is 74 percent of applied BOD. In an Army installation not shown in either curve, where a 5-ft. depth of filter rock was used, the average BOD load per cu. yd. of rock was 3.05 lbs. and the removal of 61.8 percent. The results represented by point "H" of Fig. 2, were determined by the same investigator who supplied the results represented by point "C".

It should be borne in mind that the various points shown in Fig. 2 are not for a single analysis, but are the average results of a number of analyses.

In view of the large number of analyses that were used to plot Fig. 1, and by reason of the subsequent results as plotted in Fig. 2, it would seem that the curves could serve as a very good guide for an operator to determine whether or not the BOD removal of his filters is satisfactory. Certainly if his data varies as far from the curve as E-1 results, he should check his plant to see if some condition is preventing his filter from producing a higher efficiency.

Getting Good Results

Here are some guide posts to better results from your trickling filters:

1. Use reasonable instead of excessive filter loadings.

2. Use a two stage plant rather than a single stage plant for strong sewages.

3. Use sufficient recirculation to keep the effluent BOD down to a proper level.

4. Watch the digester and return a good supernatant rather than a bad one to the plant.

5. Pump sludge frequently from the primary settling tank; we have obtained the best results by pumping sludge every hour of the 24 from the primary to the digester by means of a time-clock controlled sludge pump giving 3 to 4 minutes pumping every hour.

6. Rock of the proper size in the filter bed, and not too much small rock, is essential.

7. Prevent excessive mineral oil from passing through the primary tank to the filter.

8. Insure good distribution on the filter surface through a well designed distributor, good ventilation and proper maintenance.

9. Avoid too many shutdowns; the more constant the operation of the filter, the better the results; a two-minute shutdown will change the quantity of sludge discharge from the filter.

10. Good housekeeping habits on the part of the operator bring about the best results from each mechanism of the plant.

11. Good skimming in a primary clarifier seems to be very important, especially from the standpoint of removing floating mineral oil before it comes in contact with the filter. From the standpoint of overall plant results, we believe that good skimming in the final clarifier is also important. The removal of this material insures a lower BOD in the plant effluent than if the scum were not removed.

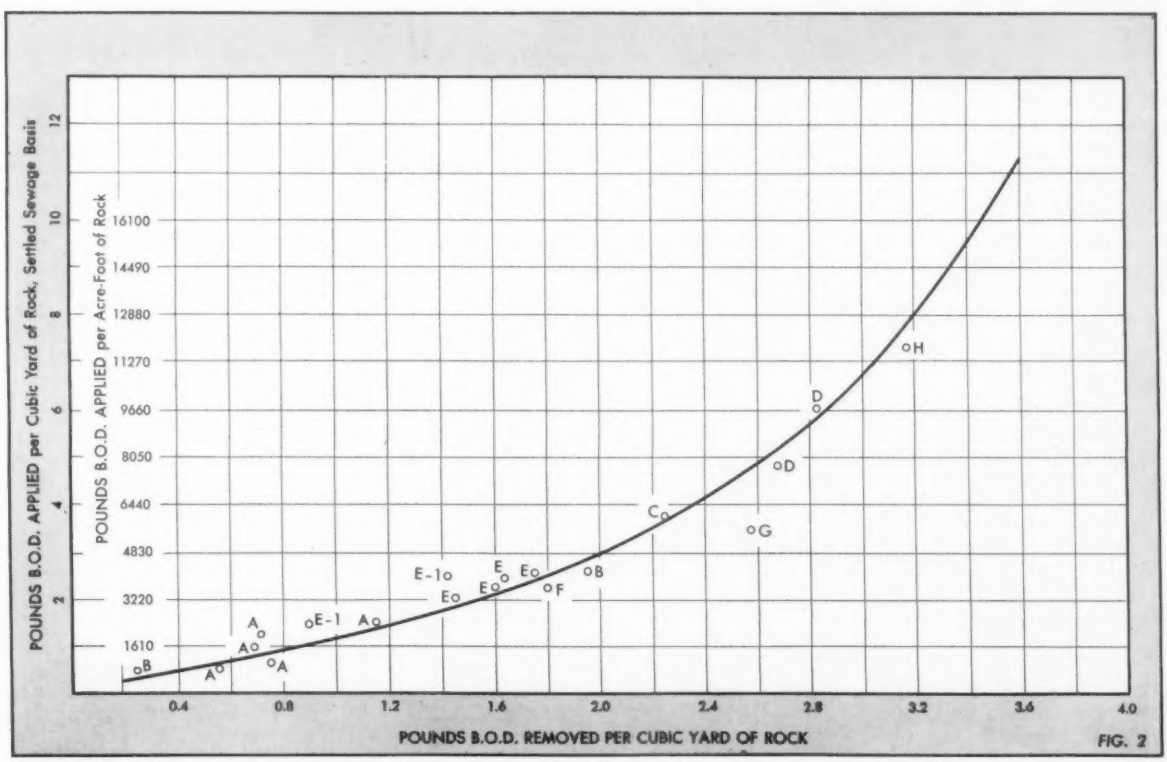


FIG. 2

● **RESULTS OF NEW DATA compared with the original curve in Fig. 1. Eight additional plants were investigated here.**

ENGINEERING A COUNTY HIGHWAY

THE OTTER TAIL County Minnesota Highway Department, organized about 1914, consists of a qualified professional highway engineer, his staff and field crews. The engineer is appointed by the Board and approved by the State Highway Department. Five commissioners representing various districts in the county are elected and serve for four-year terms on a rotating system so there are never more than three new members every two years. The County Highway Engineer is appointed by the County Commissioners for a four-year term after serving a one-year period of probation. He directs all county highway personnel and is responsible for the 1048 miles of road under county jurisdiction.

The county owns 11 garages and rents four others which are geographically situated throughout the county to afford the best possible maintenance facilities at all times. The main repair shop at Battle Lake is inadequate, but plans for the future include a new garage at Fergus Falls to reduce operating costs for repair work. The main storage garage is located on 12 acres of land in Fergus Falls which is also the site of the future main repair shop. This garage cost approximately $45,000 complete and is modern in all respects. District garages located at Pelican Rapids, Perham, Erhard, and Vining cost approximately $12,000 apiece complete. They are constructed of glazed tile and contain an overhead hot air heating system. Each of these 40 by 60-foot garages is built on an area of three acres or more to provide ample storage room.

At the present time the county owns the following equipment: one ½-yd. shovel; 20 motor graders (100 HP); one rotary snowplow, three auger; three 7½-ton 4-wheel drive trucks; one 10-ton 4-wheel drive truck; one sign truck; 16 small trucks; four power mowers; two pneumatic-tired rollers; one small distributor; one pulvi-mixer; one power broom; one conveyor; a drill for testing gravel pits and soil; six pickup trucks, three panel trucks for survey crews; and an elevating grader attachment for a motor grader.

● **GARAGE, 40 by 60 ft., cost $12,000 complete; there are four of these in county.**

In 1954, the 341 miles of state-aid roads required an expenditure of $214,883 for maintenance, or an average of $630 per mile. During the same period, county-aid roads required $283,727 for 707 miles, for an average of $401 per mile. Since 1930, the state-aid mileage has held fairly constant, varying between 356 miles in 1930 to 341 miles in 1954. The county-aid mileage has gradually increased year by year from 61 miles in 1930 to 707 miles in 1954, thus increasing the responsibility of the county at a much faster rate than the road and bridge fund income has increased. In 1954, the total maintenance expenditure amounted to $498,610, while the total income was $705,554; thus 70.7 percent of the total income was spent directly on road maintenance. This high percentage of income spent on maintenance proves that there are too many miles in the county system to take care of adequately. The county is levying the maximum legal limit of 20 mills on its $19 million valuation, which amounts to about $380,000. This amount cannot begin to take care of maintenance expenditures; in fact, it is approximately $118,000 short. The remaining $325,500 of the $705,500 income is the county's share of gasoline tax and state-aid. Approximately 200 miles of the present county system should be returned to the townships for maintenance, as these are roads of local interest only. Roads serving local people should be maintained by their own local government, whether it be municipal or township. The county system should be roads that carry intra-county traffic from adjacent counties to points of interest within the county, not merely serving a few people within a township.

Transition in Road Building

In the last three or four years, maintenance and construction ideas have changed, and the transition is primarily from a graded and graveled road to the construction of heavy base and bituminous surfacing. In 1951 there were 35 miles of bituminous surfacing compared to 185 miles in 1954; at the end of 1955, there were some 235 miles of bituminous surface, so the need for motor graders is decreasing each year and more trucks for maintenance are required. In order to attract tourists to our resort areas, including our 1,006 lakes, it is necessary to construct more dustless surface roads. Properly to take care of the county, approximately 400 miles of bituminous surface highways will be needed before our major construction program is completed. Traffic has doubled in two years on the recently bituminous surfaced Otter Tail Lake Road,

WENDELL P. HUBER, Otter Tail County Engineer, Fergus Falls, Minnesota

DEPARTMENT

● **STORAGE garage in Fergus Falls; future main garage will be located on this site.**

which shows that the bituminous surfaced road does induce traffic.

Working with limited amounts of money on an over-extended highway system sometimes compels the use of unorthodox but economical means to achieve satisfactory results. The replacement of a dilapidated bridge will be discussed as an example. Normally, replacement of a span 17 feet in length, adequate to carry the required loads of present day farming, would cost approximately $20,000 or more than the cost of a mile of new grade, base and bituminous surface. Not having that amount of money available, it was decided to replace this obsolete structure with a mud sill abutment bridge with a pre-cast concrete deck. So far as we know, this is the first mud sill-concrete deck combination installed in Minnesota. Construction started on this bridge located over the Red Eye River on County Aid Road 54 on September 1, 1954, by digging a by-pass for the Red Eye River, using a drag-line, then removing the existing structure the following day. Hand excavation for the placing of the mud sill three feet below the river bed on a solid clay surface was then started. The mud sills for the abutment were timbers 12″ by 18″ by 30 ft. The mud sills for the wings were 6″ by 12″ by 12 ft. The mud sills for abutments were held apart by three 12-in. white oak timbers placed approximately at the end of the mud sill and at the center of the abutments. The timbers placed on the mud sills to support the cap were 12″ by 12″ by 9-ft. creosoted western fir. The backing for the abutments and wings were 3″ by 12″ and the cap was 12″ by 12″ by 28 ft., all creosoted western fir. The erection of the sub-structure was completed in nine days exclusive of the removal of the old structure. The super structure, comprising the pre-cast concrete deck, was placed on September 16th. The guard rail, painting, and bridge fills adjacent to the structure, were completed so the road was passable in the late afternoon of the 17th. The clear span of the structure is seventeen feet, with a vertical clearance of eight feet above the stream bed.

The cost of the completed structure was $4,896.32, broken down as follows: engineering, $148.07; supervision-foreman, $280.86; labor, $788.02; equipment rental, $98.70; bridge deck, lumber & supplies—pre-cast concrete deck, $1,619.52; creosoted lumber, $1,590.92; nails, bolts, dynamite, etc., $93.73; removal of old structure and channel change, $112.00; installing pre-cast concrete super structure, $164.50.

The completed structure has been giving adequate service for the minor expenditure of less than $5,000. This type of construction fits into a County Engineer's program very well, as his own labor crew can install the complete bridge.

Help for Fishermen

In designing a road approaching the Otter Tail River to meet the present grade of a bridge, an ascending 10 percent grade on the north side of the hill and a descending 7½ percent grade on the south side was encountered. As the road was designed for a 50-mile operating speed, approximately 30,000 cubic yards of excess earth had to be disposed of from the north side cut. This earth was utilized to construct a parking area adjacent to the river for fishermen. A portion of this fill was also used to construct a low level road curving down around the parking area to the river bank to afford a launching area for fishermen bringing their own boats. Schmidt bridge, crossing the river at this point, has a cat walk on both sides of the structure which allows fishing privileges, and it was for these fishermen the parking area was constructed. This parking area allowed the county to dispose eco-

● **ELEVATING grader has been an important factor in improvement of low-traffic roads. It is used for loading trucks and for dirt-casting or turnpiking on minor roads.**

● **WEED sprayer was locally designed; it works well on roadside spraying.**

nomically of the 30,000 yards of excess earth and at the same time provided safe fishing accommodations to the local and visiting sportsmen. Whenever possible, recreational facilities around the lakes are incorporated with road design, thus affording appreciated benefits to local people and to the tourists.

Control of weeds and brush is a problem in our County as in other places. To combat this unwanted growth, a weed spraying attachment was constructed in our own shops. This is mounted in the front end of a standard flat bed truck and is raised or lowered by a hydraulic lift. When using this sprayer, a roadside width of 20 to 25 feet is covered with a single pass. Practically a 100-foot right of way can be maintained by a single pass on each side of the road. A 500-gallon tank with an air compresser mounted on the top is carried on the truck body. This sprayer can also be utilized to spray grass growth inhibitor.

In the stop-gap category, we have been able to rejuvenate many miles of road by cleaning the ditches and raising low grades. For this purpose, an elevating grader attachment on a motor grader is used. This raising of low grade lines has eliminated many frost boils which were causing difficulty in the spring. This is the only type of improvement that can be given low traffic county roads at this time. The public realizes that everything cannot be reworked at one time, and therefore, this work, though minor, establishes better public relations.

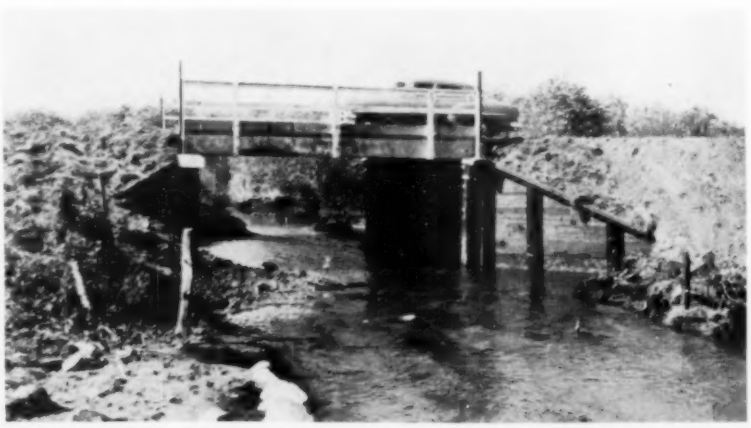
After considerable preparation, a program containing 190 miles of reconstruction, 190 miles of bituminous surfacing, and construction of 9 bridges was specifically designated for a $2.5 million bond issue to take care of a portion of the immediate needs of the road system. It was believed that if the voters were acquainted with a specific bond issue construction program showing type of work and location of projects, less opposition to a bond issue would be raised. Therefore, a county map was prepared showing the location of all proposed improvements and type of work. This map was distributed and at the same time, the voters were advised to vote on the day of the special election, either for or against the bond issue, but vote they should to determine the fiscal policy under which the county must operate. This belief turned out to be true, for the voters knew exactly what construction to expect and voted in favor of the bond issue. This procedure also has the favorable feature of relieving the county engineer and the county board from undue pressure from people requesting work on roads not included in the bond issue proposal. The County Board and County Engineer are morally and legally bound to spend the bond issue on the previously designated projects. At the time of the bond issue the county was in debt $270,000. This deficit has been paid, and at the end of the current year, Otter Tail County expects to have a balance of $200,000. The bond issue is paid off from the receipts from a special levy designated Special Construction Fund levy; therefore, the present income to the County Road and Bridge Fund will not be reduced by bond payments.

The public is becoming more and more road conscious, partly because of increased travel, partly because of deficient roads, and partly because of national publicity. People now realize that large expenditures are necessary to build a satisfactory road system, and they are beginning to realize that they, themselves, pay for every mile of road whether it is township, county, state or nationally supported. As it is impossible for the public to get a free road, a continual upward shift of township roads to county, county roads to state, merely complicates methods of financing and record keeping. It does not relieve the taxpayer of any burden. Ultimately, the responsibility of an adequate road system shifts back to the people and the amount of money they, themselves, determine that they wish to spend. If 200 miles of road are transferred from the county system back to the township and additional services or higher standards of maintenance are not required, then and only then can a normal county construction program compatible to the needs be possible to attain without any appreciable increase in county taxation.

• • •

Benefits of Commercial Weather Forecasting

More accurate planning for snow emergencies has been possible in Milwaukee, Wisc., by increased liaison with local weather services supplemented by a commercial forecaster. Once a snow alert has been called in that city, costs amount to about $1000 per hour. It is estimated that a considerable money saving will be possible with better forecasting.



● **PRECAST concrete bridge, 17-ft. span, on mud sills, cost complete only $4896, including engineering, supervision, equipment rental, labor and all materials used.**

SPEEDING INSTALLATION

OF 60,000 WATER METERS

WHEN THE City of Baltimore, Md., decided to begin operations on a major water metering program which was to include the installation of thousands of meters to lines feeding many old flat-rate multiple dwellings and business establishments throughout the city, one of the main problems confronting the Bureau of Water Supply was "time".

Since the operation of cutting in these new meters meant shutting off the water supply to many customers and digging up sidewalks, the speed of installation became a prime consideration. With this idea of customer convenience in mind, a high degree of organization for speed and efficient use of personnel had to be planned. Likewise, careful consideration to methods and materials was needed to keep costs down.

Many of the consumers' lines to be cut for meter installation were old and badly corroded, showing definite effects of being underground for many years. For the most part, the pipe was in such condition that it would not stand threading. Even if the pipe had been in excellent condition, a complete threading operation at each cut-in would have been a great handicap to the time schedule of the over-all program. Old-fashioned methods of cutting-in to install the meter yoke, and then threading the pipe ends to reconnect the line were considered not only very time consuming, but was also an almost impossible procedure because of the condition of the pipe.

Threading also presented other possible problems. These included making the joints more liable to additional corrosion; and increasing the probability of leaks from corrosion

● **GENEROUS** supply of various size couplings speeds meter installations.

● **OVERALL** view of the meter yoke and jumper as used in the Baltimore operations. The jumper will be removed later on and the water meter inserted in its place.

● **WORKER** stabs pipe into compression coupling instead of threading old pipe. Pipe cutter and wrench only are required.

● **TIGHTENING** a coupling used for a meter yoke connection. This procedure saved many hours in the program.

● **VAULTS made of concrete are lowered into place over the meter yokes.**

or from fracture of weaker threads. The Bureau, when confronted with extreme cases of badly corroded water service between the main and the curb line, renewed these services with copper tubing.

To overcome the various difficulties which were presented, it was decided that mechanical type compression couplings could be used on many settings to make the connections between the old service line and the meter yoke assembly. The couplings used were Style 65's supplied by Dresser Manufacturing Division.

A main advantage of these couplings was considered to be that they require no threading of pipe and no close measurements. They work on the following principle: Threaded end-nuts screw on a threaded coupling body, compressing a specially compounded rubber gasket against both pipe and coupling body making a non-rigid, permanent tight seal. The use of this coupling device simplified many connections and, utilizing its own men, the Bureau saved a great deal of time on the job. The men working on the line simply had to stab the pipe ends into the coupling and tighten the end nuts with a wrench, completing the connection. According to Charles H. Muller, Superintendent of Supply and Yards for the Baltimore Bureau of Water Supply, the couplings are used on 80 percent of the installations.

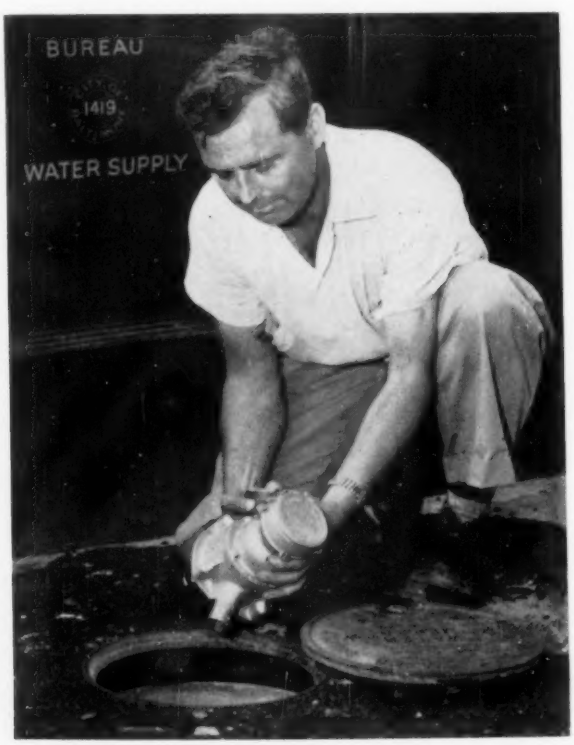
Using its own working force, the following systematic, "production-line" type of procedure was followed in the task of metering by the Bureau.

One crew of men excavated for the settings and installed the meter yokes with jumpers. Installation of the vaults, which are made of concrete, and were obtained in Baltimore from a local company, was the next step. Following this, cast iron frames and vault covers were set in place. Frames and covers were supplied by various foundries. These had several small projections around the cover rim, the purpose being to engage the sidewalk cement and hold the top flush, even though the concrete vault may later settle slightly. This engaging action also eliminated the danger of the cover rising in event of ground heaving.

In keeping with the "production-line" type of operation another crew followed to install the meters.

The entire operation is progressing smoothly, and all work has been minimized in respect to time by use of the coupling, and in respect to expense because the Bureau is able to utilize its own work forces. Since the program began, an average of 200 meters have been installed per month. This rate is gradually being increased with the eventual goal being 5,000 cut-ins a year. In all, 60,000 meters eventually will be placed. The over-all program of metering these many lines throughout the City of Baltimore is under the supervision of D. H. Goldsborough, Superintendent of Maintenance, Department of Public Works, Bureau of Water Supply.

● **FRAME and cover of the meter vault are set into place. Area is now ready for backfilling. Meters will be set later.**



● **METER installation is the final step. Meter vault has been placed and now a workman prepares to install the meter.**

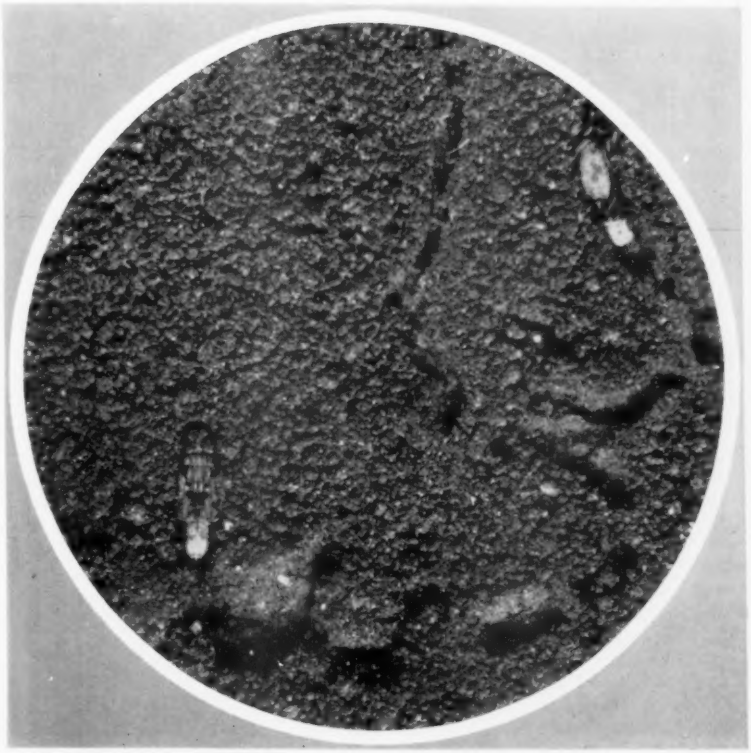
EFFECT OF EARTH COVER ON HOUSEFLY EMERGENCE

RALPH J. BLACK

and

ALLAN M. BARNES

Bureau of Vector Control
California Department of Public Health



● **ADULT FLY, lower left, forces passageway through uncompacted soil. Abandoned pupal case appears at upper right, and other passageways show at center.**

IT IS GENERALLY conceded that one of the most important reasons for burying garbage or mixed refuse is to control flies. Garbage is usually found to contain large numbers of fly larvae (maggots) by the time it is collected in most California communities. Daily cover, regardless of the depth, is effective in preventing flies from laying more eggs on the garbage at the disposal site, but may or may not be effective in preventing fly emergence. There are many recommendations made by authorities in the field as to the amount of cover necessary for the operation of a good sanitary landfill. Spencer[1], one of the frequently cited authors, recommends 24 inches of cover. However, Stiles[2] in 1910, reported the emergence of houseflies through 48 inches of sterilized sand. Smirnov[3] found that compacted earth prevented the emergence of blowflies, but few details were given.

Because of the widespread use of the sanitary landfill method of refuse disposal, and the public health aspects of the problem, an investigation was undertaken by the Bureau of Vector Control, California State Department of Public Health, to determine what conditions prevent fly emergence. The University of California Departments of Entomology and Engineering cooperated to make this work possible. Eggs of the housefly, *Musca domestica*, were supplied by the Department of Entomology. Laboratory space and assistance in laboratory methods were furnished by the Sanitary Engineering Field Station.

Houseflies go through four distinct stages during their life cycle. The eggs are deposited in moist organic matter. Each female may deposit from a few hundred to 2,000 eggs during her lifetime. The eggs hatch into larvae which feed on the organic material. The larvae go through three feeding stages, called instars, and then turn into inactive, non-feeding forms called pupae. When transformation is complete, the fly pushes off the end of the pupal case with the ptilinum, an inflated sac that protrudes from the frontal region of the head. By alternate expansion and contraction of the ptilinum, the fly opens a passageway through debris or soil to the ground surface. Next the wings are expanded and the ptilinum is withdrawn completely. After the wings dry the fly is ready to find a meal, mate, and begin the cycle again.

The following four experiments were devised as a means of testing the ability of the housefly to emerge under varied conditions. Hanford Light Sandy Loam was selected as the test soil because it occurs widely throughout California and because it can be compacted readily.

I—Uncompacted Cover of Variable Depth. One hundred 3rd instar larvae of *M. domestica* were placed in each of six 3¼ x 24 in. glass tubes and four 4½ x 72 in. Transite tubes, sealed on the lower end with "Scotch" tape and aluminum foil. The larvae were covered with ½ inch of Purina Larva Medium in which they were reared. They were then covered with varying depths of uncompacted soil at a moisture content of 6 percent. The soil had previously been screened through ¼-inch hardware cloth and thoroughly mixed to insure a uniform moisture content.

These tubes were placed in a wooden box, surrounded by 10 inches of dry sand, through which was woven a 2½ watt/ft. insulated resistance wire of the type used to maintain soil temperatures in hot houses. Daily temperature checks showed a temperature range of 25°C-32°C at the top of the level of the rearing medium, which is

favorable to the development of flies[4]. A double layer of cheesecloth was used to cover the tubes.

Heavy emergence took place in all tubes, demonstrating that soil depth up to 60 inches has little or no effect on emergence when uncompacted soil is used.

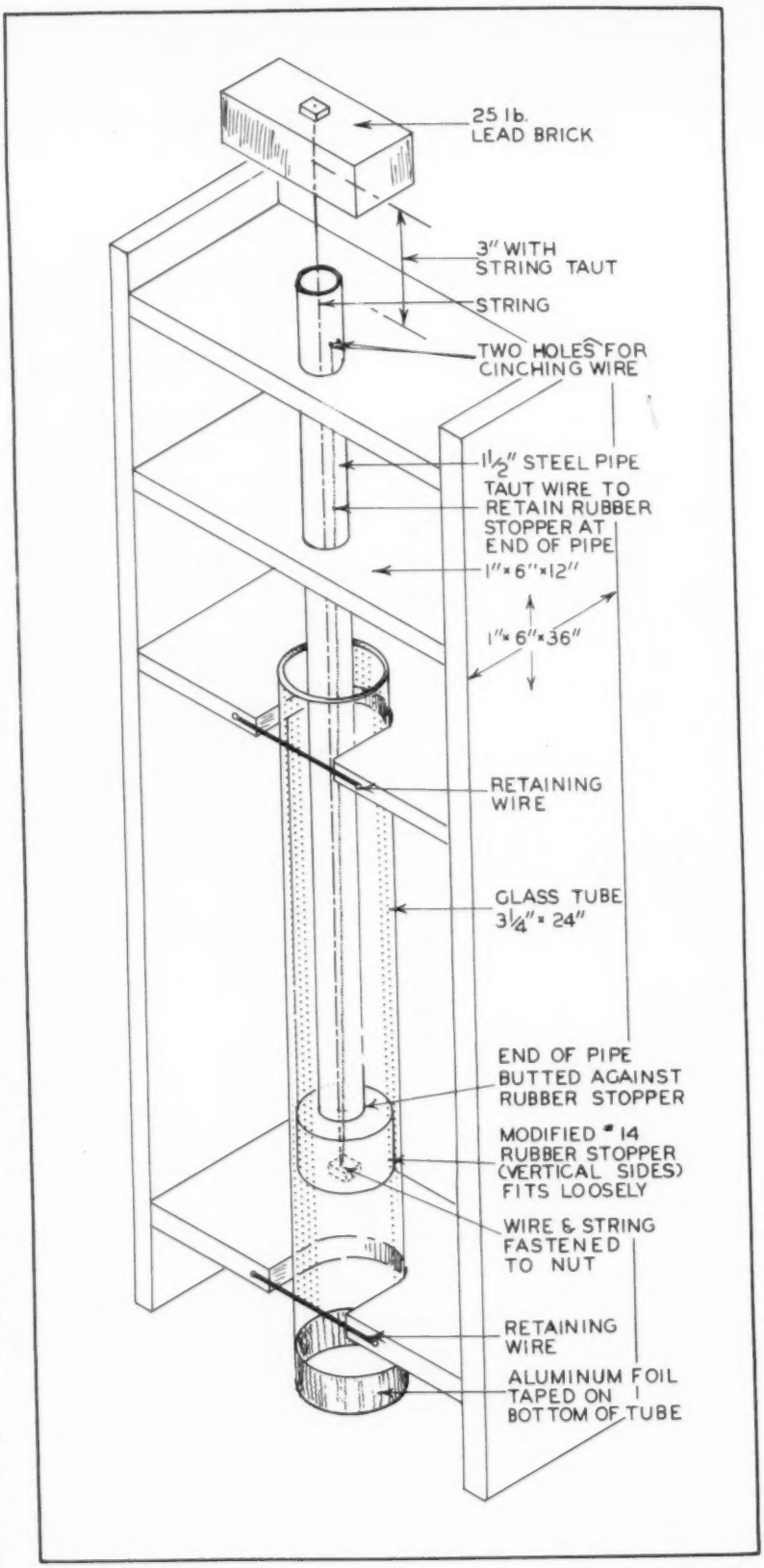
II—Compaction with Variable Depth Cover. Soil at 8.5 percent moisture content was compacted to a comparable degree in five glass tubes. The depth of the cover was varied by adding 25 cubic inch (400 ml.) increments of soil, so that the columns varied from 25 to 125 cubic inches. Each of the layers was compacted by 4 blows of a 25 pound weight. Each 25 cubic inches of soil increased the depth of the soil column approximately 1⅝ inches after compaction. A sixth tube was set up as a control, using 12 inches of uncompacted soil.

"Pockets" were then cut in the bottom of the compacted soil columns to receive aluminum pans 2¾ ins. wide by ½ in. deep. One hundred 3rd instar larvae were then placed in the pans and enough medium added to fill them. These pans were then placed top side up in the "pockets" and sealed in with aluminum foil and tape to prevent escape of larvae or adults from below the glass tubes. The upper ends of the tubes were covered with a double layer of cheesecloth and the tubes placed in the heated sandbox as in Test I.

Following emergence in the control, dry density was determined for the soil layer immediately above the medium in the five compacted soil columns.

Results are shown in Table 1. The soil layer immediately above the medium of the five compacted soil columns was dissected following emergence in the control. Although an accurate count could not be made, it was estimated that 70 to 85 percent had emerged from their pupal cases. Almost all of these flies had completely expanded wings and about 10 percent were still alive, indicating that they had been unsuccessful in penetrating the compacted soil. A number of adult flies were found trapped after having penetrated ½ inch or so of the softened soil immediately above the medium.

III—Cover of Constant Depth and Compaction with Variable Soil Moisture. Five 25 cubic inch lots of soil were measured out and water added so that the moisture content increased in 2 percent increments, between 1.4 and 8.4 percent. The moistened soil was placed in tubes



● **TEST APPARATUS** used to exert uniform compactive effort on the soil samples.

Table 1—Constant Compaction with Variable Cover

Tube	*Compactive effort*	*Dry density*	*Depth of cover*	*Percentage Emergence*
A	4 drops - 3"	1.41	1⅛"	0
B	"	1.39	2¾"	0
C	"	1.44	4⅜"	0
D	"	1.37	6"	0
E	"	1.44	7⅝"	0
*F	none	....	12"	70 - 80 estimated**

* Control; ** Upset by accident. Actual count 70%, but some escaped.

Table 2—Constant Cover and Compaction; Variable Soil Moisture

Tubes	*Field moisture*	*Added Water*	*Total moisture*	*Percentage Emergence*
A	1.4%	....	1.4%	79
B	"	1.0%	2.4%	81
C	"	3.0%	4.4%	51
D	"	5.0%	6.4%	0
E	"	7.0%	8.4%	0
*F	"	....	1.4%	83

*Control—uncompacted

Table 3—Constant Cover and Compaction; Variable Soil Moisture at High Levels

Tubes	*Field moisture*	*Added Water*	*Total moisture*	*Percentage Emergence*
A	1.5%	3.0%	4.5%	77
B	"	5.0%	6.5%	0
C	"	7.0%	8.5%	0
D	"	9.0%	10.5%	0
E	"	11.0%	12.5%	0
*F	"	....	1.5%	79

*Control—uncompacted.

and compacted as in Test II. A sixth tube was set up as a control, using 25 cubic inches of uncompacted soil. Larvae and medium were placed in the tubes as in Test II. Some difficulty was experienced in keeping the soil undisturbed in those soil columns having low moisture content. The thickness of the cover varied from 1⅝-2¼ inches. Results are shown in Table 2.

Dry density was not determined due to the difficulty of obtaining samples from those soil columns of low moisture content.

Most of the flies trapped in tubes "D" and "E", Table 2, had emerged and appeared to have been normal adult flies as in Test II. It was apparent that the flies had pupated and been trapped beneath the soil layer. Where flies had emerged through the soil, emergence holes were noted. There were 31 emergence holes in tube A, 11 in tube B, 1 in tube C, and none in tubes D or E.

IV—Cover of Constant Depth and Compactive Effort, with Variable Soil Moisture at Higher Moisture Content. Five 25 cubic inch lots of soil were measured out and water added so that the moisture content increased in 2 percent increments, between 4.5 percent and 12.5 percent. Other procedures were identical to those used in Test III. Results are shown in Table 3.

Free water was observed in this soil at a moisture content of 12.5 percent. Under conditions of constant compactive effort, sufficient compaction to prevent fly emergence is achieved in the total moisture content range between 6.5 and 12.5 percent.

Summary and Conclusions

Uncompacted soil (Hanford Light Sandy Loam) to a depth of 60 inches was not a sufficient deterrent to the emergence of houseflies. When compacted at 8.5 percent moisture content (expressed as per cent of dry weight) the soil cover prevented fly emergence at a depth of only 1⅛ inches. In the range of 6.5 to 12.5 percent moisture content, fly emergence was prevented with a compacted cover layer which varied from 1⅝ inches to 2¼ inches.

There are two phases of fly control work that are important in the operation of sanitary landfills: (1) preventing further oviposition, and (2) preventing fly emergence. Further oviposition can be prevented by covering thoroughly all exposed refuse every day. The thickness of the cover will depend upon the nature of the material available, but in most situations only a thin layer is sufficient.

Fly emergence can only be prevented by compacting the cover at or near the optimum moisture content. Laboratory tests indicate that compacted cover of as little as three to six inches should prevent the emergence of houseflies under field conditions.

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3. Smirnov, E. S.—"Mechanical Control of the Larvae and Pupae of Synanthropic Flies" (In Russian) Med. Parasitol. 11 (4): 99-105. Moscow, 1942. See review of Applied Ent. 32 (6) Series B, 119-120.
4. Dakshinamurty, S.—"The common housefly, *Musca domestica*, and its behavior to temperature and humidity", Bulletin Entomological Research, London 39: 339-357.

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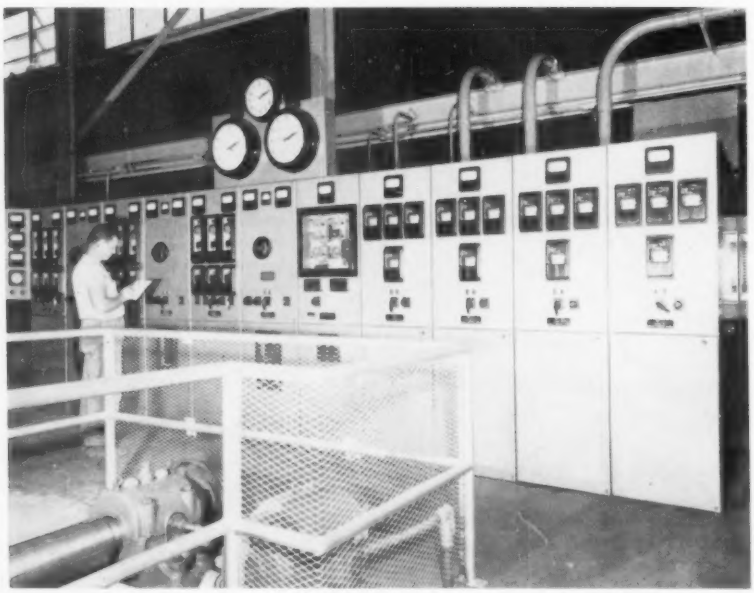
Refuse Disposal by Landfill Proposed for Montgomery County

A report has been made by consulting engineers to Montgomery County, Ohio, in which Dayton is located, recommending creation of a refuse and garbage district covering the entire county, Disposal by landfill is recommended, with operations under direction of the County Sanitary Engineer, not the Health Department; with selection of landfill sites on the basis of land reclamation for future use; and with cooperative participation by all unincorporated municipalities in the County. The annual operating cost is estimated at $137,000; and the initial cost at $237,000, which is to be financed through the issuance of revenue bonds.

BRACKENRIDGE

Builds Its Own Power Plant



● **TAKING a log reading at the 11-panel switchboard which is equipped with a swinging synchroscope and solenoid-operated circuit breakers of the drop-out type.**

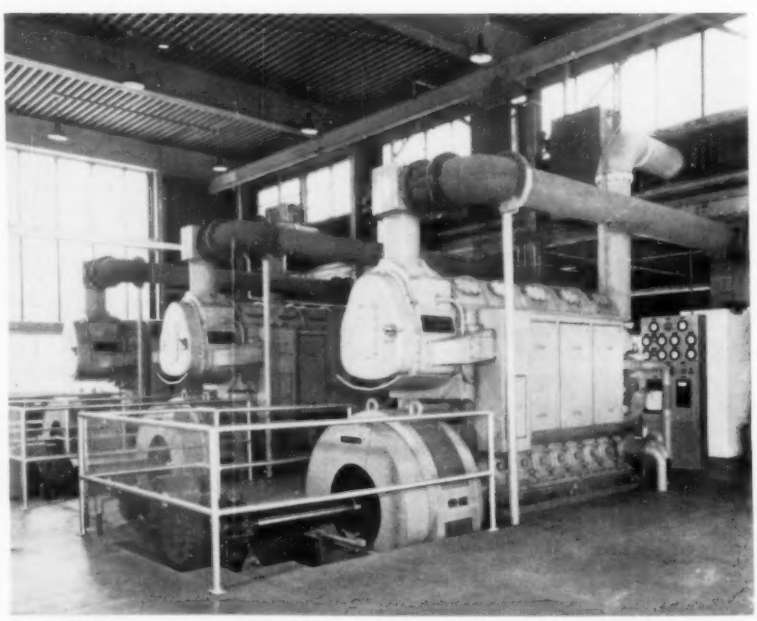
FOR 38 YEARS the Borough of Brackenridge, Pa., purchased power, but in 1952 the local privately owned utility served notice that it could no longer continue operation and that its consumers would have to look elsewhere for service. The citizens of Brackenridge decided to build their own power plant and in mid-1952 voted a 20-year bond issue for that purpose. Three 960-hp. Fairbanks-Morse opposed piston dual-fuel engines were ordered and a new all-steel power house was constructed on a hill overlooking the Allegheny River.

March, 1955, marked completion of the first year of dual-fuel operation at the Brackenridge plant. In the 12-month period, the three F-M engines had generated a total of 5,656,800 kwh at a total production cost, including fuel oil, natural gas, lube oil and station labor, of $48,407.74. This represents an average of 8.55 mills per kw. hr. Actually, operation for an 11-month period, during which all production at the plant was by dual-fuel, showed an average cost of 8.36 mills per kw. hr.

These production cost averages compare to an average price of 12 mills per kw. hr., paid for 5,196,000 kw. hrs. purchased in 1953. The Borough has always maintained its own distribution system so that in comparing present and past costs, distribution expenses may be taken as constant.

Natural gas is delivered at Brackenridge at the high price of 42¢ per 1,000 cu. ft., including discount, which led some to fear that an investment in dual-fuel equipment might not be justified. The plant's operating records for 11-months when dual-fuel was used show how effectively the efficiency of the engines compensated for the high fuel prices. In producing 5,241,600 kw. hrs. they consumed a total of 53,006.1 MCF of gas at a cost of $22,262.53; and 53,052 gals. of pilot oil at a cost of $5,927.08. This represents a total fuel cost for the

(*Continued on page* 184)

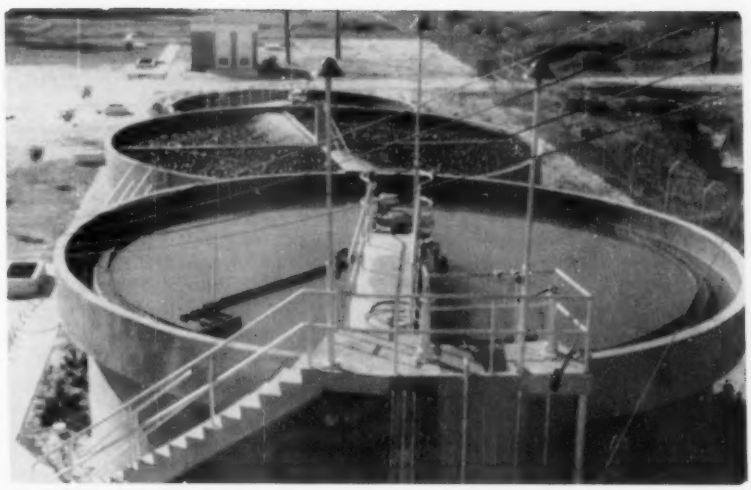


● **INTERIOR view of the Brackenridge municipal power plant. This overall view shows arrangement of the three dual-fuel engines and their respective alternators.**

DESIGNING A SEWAGE TREATMENT PLANT FOR A FARM COLONY

L. S. SHIELDS, JR.

Reynolds, Smith & Hills,
Consulting Engineers
Jacksonville, Florida

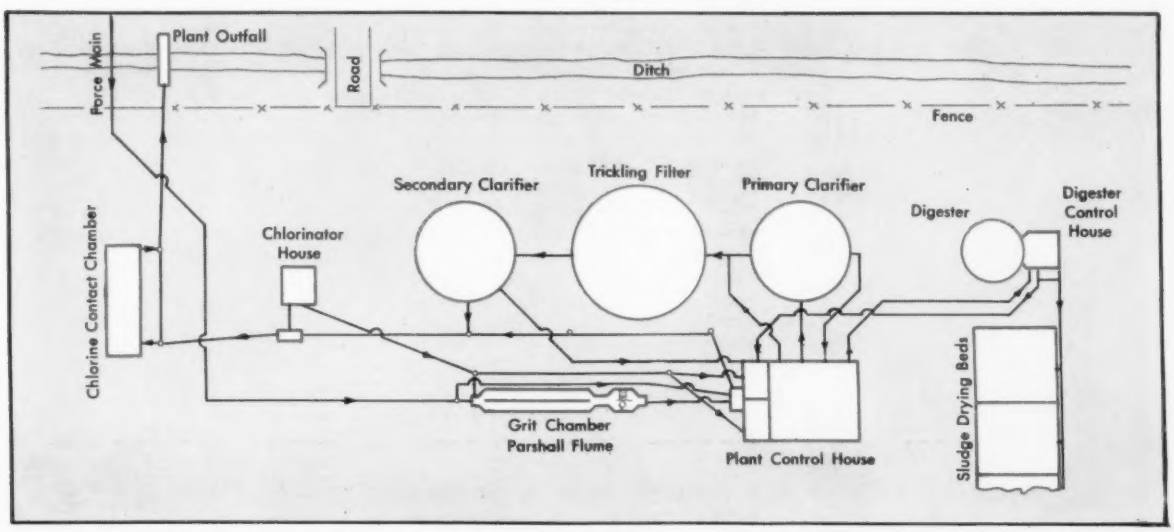


● **GENERAL VIEW of the plant as seen from digester roof. The primary clarifier, foreground, is almost entirely above grade to provide gravity flow to other units.**

OUR DESIGN of a new and complete sewage treatment plant for the Florida Farm Colony at Gainesville began with an interoffice memorandum which stated the approximate present and future patient and employee population, the type plant facilities to be designed, and the total cost to be incorporated into the State budget.

We discussed with the Superintendent all possibilities of future expansion as well as the expansion presently being planned at the Farm Colony. He informed us that the patient population, at that time, was 629 and the employee population 71, making a total of 700; and that the total future patient population should not exceed 2200 plus 300 employees. For this design population, we provided a capacity of 150 gpcd for patients and 100 gpcd for employees.

Our first step, having established our design flows, was to increase the capacity of our existing sewage lift station. We accomplished this by adding a new 500 gpm at 25 ft. TDH pump in the space originally provided. We replaced the existing 6-in. force main to the sewage treatment plant with a new 8-in. cast iron force main. At the treatment plant, to handle the peak flow, we controlled the velocity through the chamber with a 6-in. Parshall flume so that approximately one foot per second velocity is maintained throughout the forty feet of grit chamber length. We set the bottom slab of the grit chamber on grade and the top of the channel wall approximately three feet above grade. There is capacity for a ten-day grit storage in each channel bottom; however, we recommend cleaning the channel every two to four days,



● **PLANT LAYOUT and piping diagram for the Florida Farm Colony sewage treatment plant, designed for 2500 persons.**

and have provided a stationary Marlow 50-gpm at 12 ft. TDH dewatering pump at the influent end of the grit chamber to help the operator with this task. We installed a Sparling float level indicator and transmitter on the upstream leg of the Parshall flume. This float meter electrically transmits the plant influent flows to a Sparling 60-day Scriptograph totalizer, indicator and recorder located in the plant control house laboratory. Immediately downstream from the Parshall flume, we installed a Worthington comminutor with a capacity range of 0.4 mgd to 2.3 mgd. A bypass bar screen with ¾ in. openings is installed for use at night and when there is a power outage. The screen, which is removable for repair, is inclined on an angle of 35° to facilitate cleaning.

From the grit chamber the sewage flows to a division box immediately before the plant control house wet well; and thence to either of two sides of the plant control house wet well; or if the shear gates on the openings to the wet well are closed, as they normally would be in case of power outage or emergency, the sewage, after reaching an overflow level in the division box, can overflow to the chlorine contact chamber or directly to the effluent line and to a ditch. The division box is covered with one inch Bourdon grating, so that it can be washed and kept clean easily. The size of this division box was governed by the pipes into and from it. The plant control house wet well was designed for six minutes detention at maximum flow plus recirculation. The wet well is constructed in two separate sections, each with a weir box and weir to measure secondary recirculation. (One box is for future conditions). This wet well was designed with a 45° sloping bottom to prevent the buildup of solids. The wet well also was designed with piping for present and future pump suction lines installed.

The level in the wet well is controlled by a standard ceramic float and float guide connected to a "Rototrol" float control that cuts in and turns off the three pumps presently installed in the dry well. This float control is large enough so that in thefuture it will control six pumps. The present operating sequence is set so that the 400-gpm pump is turned on when the sewage level rises two feet above the cutoff level. If this pump cannot handle the sewage flow and the level in the wet well continues to rise, the 400-gpm pump is cut off and the 550-gpm pump is cut on. If this pump cannot handle the flow, then it is cut off and the 700-gpm pump is cut on. When the 700-gpm pump is cut on, at high level, the alarm horn blows and continues to blow until turned off or until the sewage in the wet well is pumped down to the low water pump shut-off level. In the future three additional pumps of the same characteristics as the three now installed will be added. Then like pairs of pumps will work together.

The plant control house wet well is open, 24 ft x 8.5 ft x 6 ft deep (inside); the sloping bottom decreases the effective size of the wet well, but it is practically self-cleaning and requires less attention from the operator. The plant control house was designed to house all the electrical controls; the sludge transfer pumps; a workshop; a lavatory with lockers, toilet and shower; and a complete laboratory with equipment to perform all of the necessary sewage and water tests. The basement of this plant control house is a monolithic concrete structure which contains three sewage lift pumps, two recirculation pumps, and space to duplicate the existing pumps. The lift pumps are Fairbanks-Morse pumps with bladeless impellers, 400-gpm, 550-gpm and 700-gpm. These pumps transfer the sewage from the wet well of the plant control house to the primary clarifier. There are also two F-M recirculation pumps rated to deliver 200 gpm at 20 ft. TDH.

The dry well also contains a Fairbanks-Morse submersible sump pump, 2700 gph at 15 ft. TDH. The effluent from this pump is discharged to the sewage wet well of the plant control house. For ventilation, we specified an American Blower capable of delivering 1600 cfm at ¼ in. static pressure. This blower takes fresh air from above the first floor through an automatic louver and aluminum duct work and blows this fresh air into the dry well at a rate that will replace the existing air every two minutes.

The laboratory is located on the first floor of the plant control house and is equipped with a sink, still, scale and balance, refrigerator, BOD incubator, a steam bath and aerator; propane gas and electric supply systems; an oven; a muffle furnace; and other necessary equipment and chemicals.

The sludge transfer pumps are 4-in. Marlow pumps, 50 gpm at 40 ft. TDH. These are plunger pumps with motor belt V-shaft drive. The sludge pumps are manually started and stopped from either the pump or at the sludge pit rail on the primary clarifier. We provided air chambers on both suction and discharge sides of these pumps.

We also provided a Marlow portable gasoline driven centrifugal pump for general dewatering purposes. This has rubber tires and is capable of delivering 220 gpm at 40 ft. TDH, is self-priming and can be used in lifts up to 25 feet. This pump is driven by an air-cooled gasoline engine.

The primary clarifier, 35 ft. in diameter and 9 ft. deep, provides 2 hrs. detention and has an over-flow rate of 800 gallons per square foot per day. Mechanical equipment was furnished by Dorr.

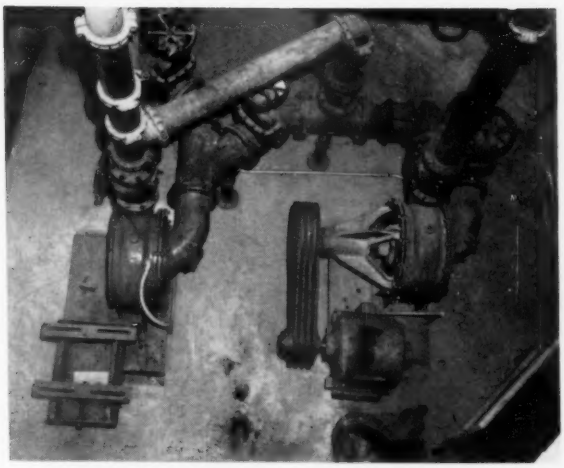
The sludge digester is designed so that another digester can be added to the opposite side of the digester control house. Present capacity is 3 cubic feet per capita, with the initial tank designed to take care of expected future population. The size of the initial tank is 20 feet in diameter (inside) with a side water depth of 24 ft. The piping in the digester control house is designed so that the digested sludge can be recirculated to mix with the influent sludge and accelerate digestion time. The sludge recirculation pump is a 3-in. Fairbanks-Morse. The supernatant piping is designed with quick-closing valves at three different levels so that a clear supernatant can be returned to the plant control house wet well.

The high rate trickling filter, 45 ft. in diameter, has a Dorr distributor. Design loading of the filter is 1.25 pounds per cubic yard and the

(*Continued on page* 189)

● **INFLUENT end of the 40-ft. grit chamber. Parshall flume in background maintains velocity of one ft. per sec.**

● LOOKING down the manhole at the Whittier raw sewage lift station. Not a single stoppage in 14 months operation.



● THIS is a 6-inch Wemco raw sludge pump in service at the County Sanitation Districts Joint Sewage Treatment plant.

SOLVING DIFFICULT PUMPING PROBLEMS at a SEWAGE TREATMENT PLANT

NORMAN W. ANDERSON,*

Supervising Civil Engineer,

Los Angeles County Sanitation Districts

SOME TWO YEARS AGO the engineers on the staff of the Sanitation Districts of Los Angeles County were challenged with the problem of finding a successful method to clean some of the large digesters at the Districts' Joint Disposal Plant. The problem was primarily the removal of a large amount of sand that had accumulated in the first stage of the digester batteries. Many ideas were advanced and thoroughly studied as to cost and feasibility.

One of the more interesting and yet seemingly remote ideas was the one for the removal of the sand by pumping. If the problem was sand alone a solution was at hand with a number of sand pumps available on the market. However, the sand contained rags and the usual other contaminating materials that would quickly bind the conventional sand pump.

One of the engineer's inquiries did, however, reach officials of Western Machinery Company in San Francisco. Although they had a sand pump, it was the potential of a solids pump to which they had recently acquired the rights of manufacture that quickened their interest. The Districts' engineers reviewed drawings of this new pump with the Western Machinery Company representative and found that the pump operation was based somewhat on the principle of half a torque converter, with the impeller recessed back of the volute. This idea of a recessed impeller enabling the bulk of the solids to pass through the volute without making contact with the impeller appealed to the Districts' engineers.

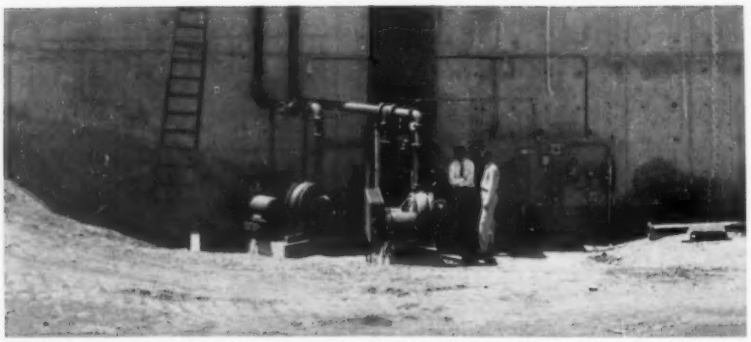
Shortly thereafter, an arrangement was made whereby Western Machinery would supply the Districts with a 6-inch torque flow solids pump, as this Wemco pump is called, on a trial basis. It is the writer's understanding that the first pump was literally hand-fashioned, although it clearly resembles the production models on the market now.

In the interim period while awaiting shipment, a very urgent problem arose at the Districts' Joint Disposal Plant in the matter of raw sludge pumping. One of the 8-inch conventional non-clog pumps pumping the sludge from a battery of four sedimentation tanks designed for an average sewage flow of 30 million gallons per day had become a real problem in efforts to keep it from clogging. As the digester cleaning problem was not quite so urgent at the time of shipment of the first pump, it was placed in this duty of raw sludge pumping. The head capacity characteristics of the pump are 500 GPM at 10 feet TDH.

The pump was installed December 29, 1953, and operated continuously until June 18, 1954 when the first stoppage occurred due to a wedge shaped piece of material lodged between the impeller and the wear plate. This performance was quite a record in that the previous installation had clogged at least once a day.

The second stoppage was September 7, 1954 and was due to an accumulation of hair and rags between the impeller and the wear plate. Some thought was given to the possibility that too much clearance was the cause of these stoppages and so a new wear plate was purchased to be installed at the next stoppage. At this writing approximately one year later, the wear plate still has not been installed. This pump was the original hand made unit; the manufacturers have, since that time, made design im-

*Mr. Anderson died last December.



● SLUDGE recirculating pump, 6-inch, is installed adjacent to digestion tanks.

provements which are incorporated in the newer units. Because of the exceptional performance of this first unit, five additional sludge pumps have been specified for service in various parts of the Districts' Joint Disposal Plant; and at this time a total of 14 of this type of pump are in use.

An additional 6-inch pump was immediately ordered to handle the digester cleaning problem. This pump has handled the sand, rags, and other materials in cleaning the digester without incident. The total problem has not been resolved as there are many difficulties involved in moving sand in a large digester as well as handling it in relatively long suction and discharge lines.

A mechanical shaft seal was furnished with this particular pump and has proven unsatisfactory. Some combined efforts on the part of the operators of the Joint Disposal Plant and representatives of the seal company have seemingly produced a solution to the problem. The pump has operated without incident from the seal for over three months in spite of handling the excessive quantities of grit.

One of the Districts' small sewage pumping stations was the source of excessive pump maintenance troubles due to an exceptionally heavy rag load. The plant is a conventional small lift station with two pumps—one serving as a standby for the other in the event of stoppage. Although each pump was protected by a hand-raked bar screen, complete stoppages were occurring in the order of two to three times per week. A 4-inch torque flow solids pump capable of delivering 200 GPM at 13 feet was obtained from the Western Machinery Co. on a trial purchase plan for duty in the installation. The pump was installed in September 1954 and the protective bar screen removed at the same time. This pump has served continuously to date without a stoppage.

As mentioned previously, five additional pumps have been purchased for service at the Joint Disposal Plant. Two of these pumps rated at 400 GPM at 40 feet will be used in a digester recirculation and heating system. The remaining three have been installed in a raw sludge pumping station. Specifications called for a pump capacity of 500 GPM at a total head of 54 feet. No. operational data are available from these units as yet.

FIELD KIT SIMPLIFIES BACTERIOLOGICAL TESTS

THE "Field Monitor" is said to be a fundamental new tool in the application of the Millipore filter to microbiology. The article deals with the application of presterilized components of accessory equipment and the basic new unit, the "Field Monitor" which facilitates the application of the Millipore filter to the collection, cultivation and observation of samples and, at the same time, introduces refinements in technique. The basic plastic Field Monitor fills the function of an MF* filter holder and incubation dish.

All of the required presterilized, expendable elements for routine bacteriological water tests are contained in the Field Monitoring Kit. Tests may be run to completion un-

● EACH cell in the original sample will develop into a colony readily observable to the eye in 16 to 20 hours. Differential media will provide identification means.

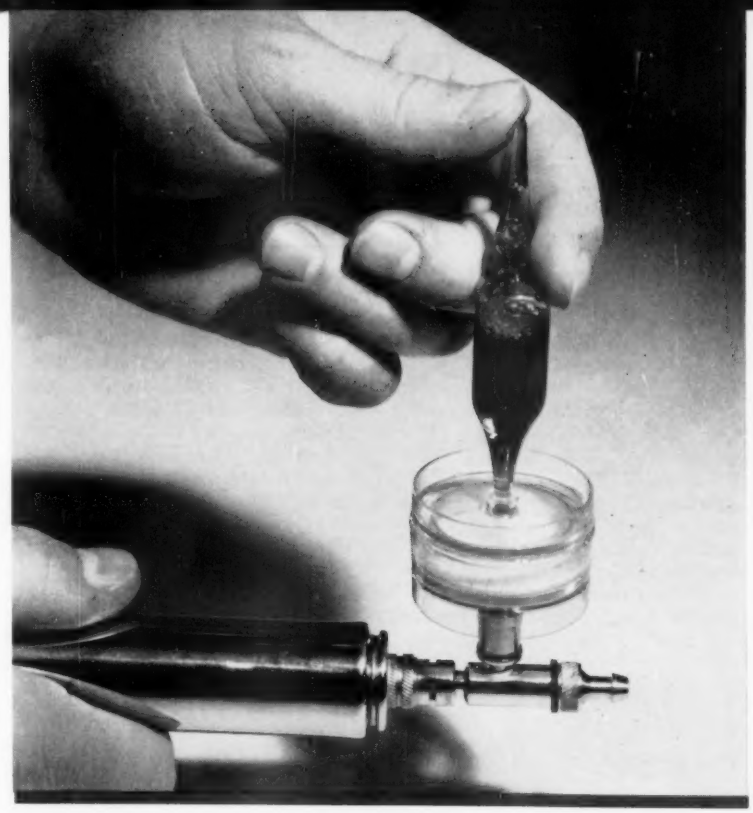
*MF is a Registered Trade Mark of the Millipore Filter Corporation.

der field conditions with no laboratory facilities necessary; or, alternatively, bacterial samples isolated on the MF surface may be forwarded to a central laboratory under conditions which preserve bacterial populations. It has long been recognized that the practice of shipping bottled water samples through the mails to a central laboratory introduces variations in bacterial populations which raise questions as to the validity of results. These variations are caused in part by antagonistic and/or symbiotic interaction between cells within the water sample, as well as abnormal multiplication or mortality of organisms.

Application of the Field Monitor reduces cells to the MF surface where they are isolated such that there is no apparent inter-action. Each cell acts quite independently being supplied with nutrient diffused directly through the membrane structure from the bottom surface and inter-action between cells is not observable with a proper number of cells (controlled by sample size) on the filter surface. Each cell isolated on the MF in the Field Monitor will become a colony on incubation; hence growth will not influence the subsequent colony count as related to the original sample. Media has been developed which effectively preserves the viability of coliform organisms and minimizes growth, permitting latitude in time elapsed in shipment. A substantial saving in cost is realized by shipping samples in the Field Monitor as against shipping water bottle samples.

The principal advantages realized with the application of the Field Monitoring Kit for water bacteriological control may be summarized as follows:

1. Sample volumes may be large and representative.
2. Shipment of liquid samples may be eliminated by filtering onto the MF membrane in the Field Monitor at the source, thus reliably preserving samples in shipment.
3. Dishwashing and sterilization of apparatus and materials is eliminated.
4. No laboratory facilities are required.
5. Possibility of error is reduced.
6. "Closed System" Presterilized components insure aseptic procedures.
7. Valuable professional time is saved for more critical laboratory operations.



● **MEDIA is introduced from a sterile ampule for incubation, which may be carried on after samples are mailed to the laboratory; or they may be incubated in the field.**

● **SAMPLE of water may be filtered at the source, reducing bacterial cells to the MF surface. This is first testing step.**

● **FIELD incubator may be operated on 6 or 12-volt systems, as from an automobile cigarette lighter; or on 110-220 volts.**

ENGINEERING ADMINISTRATION

A. E. STILSON

Consulting Engineer,

Columbus, Ohio

CONSULTING ENGINEERS charged with the design of a Toll Road must possess many different skills, each representing a distinct branch of engineering. One phase of the problem may be of interest. It touches upon all operations, both of design and construction. This phase can be called Administration of Engineering Forces on a Toll Road. The experience of our firm acting as the Consulting Engineer for Design on section D 17, comprising three contracts, 47, 48 and 49 of the Ohio Turnpike, can be used as an illustration.

● **COMPLEX structure on the Ohio Turnpike illustrates some of the problems involved in design. Shown here is Anthony Wayne Trail and Detroit Ave. Intersection.**

Section D 17, 12 miles in length, beginning on the west bank of the Maumee River and extending westward through the City of Maumee, which is actually a suburb of Toledo, includes deep cut, high fill, a stream, railroads, an interchange at busy Route 20 and complicated drainage and soil problems characteristic to the south shore of Lake Erie. There were also legal obstacles posed by a rapidly growing urban community.

Governor Lausche, acting under powers conferred by the Ohio Assembly, assisted by the Department of Highways of the State of Ohio and working through the Ohio Turnpike Commission—created by an enactment of the 98th General Assembly —determined that a turnpike should be built across the northern portion of the State of Ohio from Indiana to Pennsylvania. The J. E. Greiner Company of Baltimore, Maryland, was engaged as the Consulting Engineer for the project, to recommend a line, suggest the type and estimate the construction cost of the project. Parsons, Brinckerhoff, Hall and Macdonald of New York City was selected to prepare a report estimating traffic and revenues for the proposed turnpike. Their work was begun in May, 1950. Location studies were accomplished in time to be studied and approved by the Governor in November, 1951. Leading investment bankers of the Nation were called together to act as a Financial Advisor group to the Commission.

In November, 1951, the Financial Advisor group recommended that the Governor call the General Assembly into an extra-ordinary session for the purpose of correcting certain deficiences in Ohio Laws regarding the appropriation of private property. In March, 1952, the Legislature accomplished this task. On July 29 the Commission issued $326,000,000 of 3¼ percent bonds to mature June 1, 1992.

In the winter of 1951-52, the Commission selected Consulting Engineers who were to do the detailed design work on and supervise the construction of the several sections. These consultants were termed Contracting Engineers. These Contracting Engineers were informed of the assignment to be given each of them. At the same time they were told that, to meet the time schedule for completion asked for by the Financial Advisor, the Contracting Engineers would be expected to go to work before the bonds were sold and money made available to pay for it.

Each Contracting Engineer was faced with important and difficult administrative questions.

First: What fee should be charged for the work of designing a section, preparing the specifications and supervising the construction?

Second: What will it mean if the work is undertaken and subsequently the bonds are not sold?

Third: What methods must be used to accomplish the work with the speed necessary to meet the time limit?

Fourth: How many men will be required; how will they be assigned; and where should they be located?

Fifth: Each Contracting Engineer had a full work load; regular clients were depending upon him. Where can the men necessary to augment present forces be obtained?

Sixth: Where and how is the money to finance the Contracting Engineer's operations to be obtained?

When called by the Commission to sign contracts, it was not a time

FOR A TOLL ROAD

for the Contracting Engineer to develop a faint heart or—worse yet—indulge in wishful thinking.

The signing of the contract took place the morning of July 2, 1952. In the afternoon our men were on their way to Maumee, Ohio, Design Section 17. Upon arrival, local sources were canvassed for skilled and non-skilled men to be used in the field operations. A field office was established the following day. Sufficient men were recruited to bring our total field force for the job to 35 engineers and assistants.

These men commenced surveying operations immediately. Orders were to do the work with an accuracy of 1:10,000 horizontally and of 0.035 $\sqrt{m}$ vertically (where m equals the length of the circuit in miles). Necessarily points of beginning and ending, as well as the entire length of the project, were open country. Exact locations had to be determined using observations on Polaris.

With field work under way, office arrangements at Columbus and liaison with the field became essential. Additional office space became necessary for 40 men to handle nearly $12,000,000 work on roads, bridges and miscellaneous structures. Instruments, extra drafting tables and supplies were needed at once. A communication system between the field and the office had to be established. Special provisions for the cost accounting on the project was necessary. Meantime it was obvious that each day was precious. Each wasted hour represented heavy financial loss.

To accomplish these things concurrently kept everyone jumping. Before all of the administrative problems had been resolved, troubles developed in the field. A few examples may be amusing now, but then they were headaches. Clouds obscured the sky, after several nights of waiting, the stars came out but the men were tired. As a result, they carefully zeroed in on a planet. It is the little things that make gray hairs. An old homesteader wanted to end his days in his ancestral home which he defended with a shot gun. A retired lawyer, turned farmer at 75, demanded to see the "boss man." He had proof that the line should not go through his farm. An obstreperous real estate promoter, dazzled with visions of dollars, employed a lawyer. Both were anxious to extract riches from the Turnpike Commission and at regular intervals appeared with stop orders and law suits.

Integrating and reconciling the specifications and desires of the Consulting Engineer, the Turnpike Commission and the Department of Highways on one hand with the desires and restrictions of County and City governments on the other, presented the Contracting Engineer with problems of engineering diplomacy. Special conditions encountered on the site, which had to do with a proposed airport, soil bearing values, drainage, new homes and structures, called for administrative decisions. Different railroads, having in common only engineering departments, officials, red tape and rules, presented another problem. The Contracting Engineer finding himself faced with these individual rules and regulations, had to disentangle himself from the particular brand of red tape, and minimize the time required in making up his mind.

To meet the problems, make the decisions, placate the public, direct the personnel, review the plans, obtain approval of all concerned and head-up the supervisory forces demanded the full time of a Project Engineer. The specifications for such a man called for wide experience, technical knowledge, diplomacy and the ability to direct a group of busy men. Several men from several States were recommended and interviewed. Norman W. Wilke, former head of Planning and Programming for the Department of Highways, State of Ohio, was selected. He brought with him a fine record of accomplishment as a principal engineer in charge of the Cleveland Free Way System. He had years of experience in all phases of highway design and construction. We were able to provide him with a fine staff of engineers, including Stanley R. Rudin, Chief of Design; Gordon Moellman, as

● **FILL 41 ft. high figured in one of the emergencies when failure developed by reason of loose water-bearing sand and gravel 25 ft. below original ground surface.**

Chief of Field Operations: Gordon MacCammon and Robert D. Johnston, as heads of Survey. These men, together with the support of others, made up the design and supervisory forces which brought the work to a successful conclusion on 30 Sept., 1955, as per schedule. Throughout the entire operation, William E. Buerk, made himself available to pinch-hit in any direction. His broad knowledge of all phases of highway work played a continuing part from the very beginning to the successful ending. Without such a man the administration of the project would have been crippled.

Near the end of the design phase, legal complications arose. The Supreme Court finally established the right of the engineer to determine engineering problems on the basis of engineering knowledge without interference of special interests. This litigation interrupted the work of the Contracting Engineer and presented an administrative crisis. During the months—while the lawyers were arguing — many high salaried men were forced to stop the turnpike work. The problem of how gainfully to employ these men, maintain the team and, at the same time, reduce the incidental loss, required planning and prompt action. By diverting as many of the 75 men as possible to other work for other clients, part of the loss was minimized. For the balance of the men, it was decided to have them continue on what they were doing, and gamble with our own money that the Court ruling would be favorable.

Construction contracts for Section 17 were to be let in December, 1953, five months after the plans were completed. In July the administrative question faced us as to what should be done with the field forces until the construction season opened in March. After considering the probable costs incident to dispersing and then later reforming a fine team, the decision was made to hold the men. Tribute must be paid to these men who made every effort to provide us with a backlog of useful work during the waiting period. Their work then minimized the need for a larger supervisory staff when construction commenced.

Construction was commenced in March, 1954. The association of contractors who combined to bid the job, individually, as well as collectively, were undertaking a project of magnitude greater than they had performed previously. The names of nineteen separate sub-contractors were submitted. Most of these sub-contractors had limited experience. Their operations had to be coordinated. The time limits placed upon the construction made it essential that the work be carried on with a maximum of efficiency commensurate with speed. No allowance could be made for adverse weather conditions. The job was of sufficient size and the operations sufficiently varied that with good advanced planning only severe storms need be cause for stopping work.

● **INTERCHANGE at US 20 and Turnpike, showing toll booth where electronic devices weigh vehicles and calculate the charge that is to be collected from them.**

Inevitably when so many men representing many fields are doing many different things, arguments and delays developed. Financial and operating difficulties made it necessary for the bonding companies to assist in certain instances. In places the basic specifications and plans had to be clarified and changes or corrections made to suit the situation. Unfortunately before making their proposals, contractors often either did not read carefully, or did not understand and evaluate, the basic specifications, contracts and plans. Soil and topographic investigation was not made with sufficient care before bidding. All of these problems created administrative work of a difficult nature for all concerned.

As Contracting Engineers, representing the Commission, we were duty bound to be fair and impartial to all parties concerned. The sincere and helpful attitude of the Commission, the Consulting Engineer and the several contractors made our work possible. Despite disagreements, all united, when the chips were down, to make a team which did an excellent job.

The team work exercised is well examplified by what happened on Thursday and Friday before Labor Day. It was discovered that there was a serious earth failure far below the original earth surface upon which a high fill was placed. As this is written, studies are yet not completed which will finally document all that took place. It is enough to say that everyone united and forgot their own problems in order to work for the common end. Action was inaugurated by some of the Contracting Engineering forces who had remained on duty during the holiday period. The Contractor, Consulting Engineer and the Turnpike Commission called back all available men they could locate. Equipment wherever found was ordered to the job without waiting for normal contracting procedures. The slide was stopped and reconstruction completed. From the viewpoint of administration, the Turnpike built by the men who constituted the team, can only be described as "splendid". It is a matter of greatest satisfaction that these efforts of all were crowned with success. The Turnpike, including Design Section D 17, was opened for operation at midnight September 30th, 1955.

TIME STUDY STRETCHES YOUR EXPENDITURE DOLLAR

GRAHAM W. WATT,
Administrative Assistant to the City Manager, Kansas City, Missouri

TECHNIQUES perfected in the 20th century industrial revolution are at last finding application in local government for the benefit of the tax paying citizens. It all started before the turn of the century when Frank Gilbreth (most popularly known as the father of 12 children immortalized in the recent best seller "Cheaper by the Dozen") watched a crew of bricklayers at work. A few days later he developed a new scaffold which kept the bricklayer at the same relative height to his work as he progressed, special packets on which to place bricks, and new mortar handling techniques—all of which made it possible to lay more bricks each day (production increased 192%, from 120 to 350 bricks per hour) without increased effort by the bricklayers. Gilbreth was the first of the modern industrial engineers whose job it is to plan new production methods which will utilize all available production tool capacity, eliminate waste of time and materials, and make jobs easier and safer for the worker.

To accomplish his mission of improving work methods in factory or in office, the industrial engineer utilizes many tools and techniques, some simple, others involved and complex—industrial engineering has become recognized as a separate engineering specialty comparable to civil, mechanical, or soils engineering. Fortunately, many of the principles and techniques used to develop good work methods have been so simplified in recent years that several progressive cities have adopted them and are applying these principles to their municipal functions, with the result that they not only are able to provide municipal services at lower cost, but they usually offer more and better service as well.

Kansas City's Experience

Under the business-like administration of City Manager L. P. Cookingham, Kansas City has developed what may be the most advanced municipal work methods improvement program in the country. The city's Research and Budget Department, which is staffed largely with selected city manager trainees, developed the program which includes work simplification, management analysis, forms control, records retention and disposal, and supervisory training in fundamentals of work methods improvement.

All of these programs are designed, through study and analysis, to find better, faster, and cheaper ways of accomplishing necessary work and to discover and eliminate unnecessary work, or waste of time, effort or materials. Emphasis is placed on the way work is done; attempts to increase employee production by "speed up" above normal expected effort are not permitted, for it has been demonstrated that speed beyond a normal good working pace is not an important factor in securing increased production.

That the program has been successful is evidenced, at least in part, by the fact that the city's property tax rate is the same today as it was in 1941 despite vastly increased municipal services and higher costs, including a more than 100 percent average increase in salaries during the 13-year period.

Time study is a means of measuring the time required to perform a given task according to a specified method by a worker of average skill working with average effort under normal working conditions. Time study is a basic tool of the industrial engineer and is now recognized, even by many labor unions, as a valid method for setting production standards.

Three years ago, Kansas City first trained several employees in the use of time study as a means of setting production standards against which actual accomplishment could be measured. This was a logical, though perhaps belated, addition to the city's work methods improvement program. In the past the only yardsticks for measuring the production of employees or groups of employees have been: (1) Records of past performance as shown by periodic activity reports, which may be merely a record of relatively low production resulting from poor

TIME STUDY OBSERVATIONS ON REFUSE COLLECTION

Elements	*Stop Watch Readings Thousandths of one hour*								*Total Time Hours*
No. 1—Pick up garbage can, carry to truck, dump	89	47	72	81	106	61	89	85	.0630
No. 2—Return can and replace cover	64	41	48	67	97	47	25	79	.0518
No. 3—Walk to next garbage can	14	25	132	22	36	39	16	19	.0303

COMPUTATION OF TIME ALLOWED PER ELEMENT

	Element No. 1	*Element No. 2*	*Element No. 3*
Total Time	.0630	.0518	.0303
No. of Observations	8	8	8
Average Time	.00788	.00647	.00379
Leveling Factor*	*1.08	1.08	1.08
L. F. x Average Time	.00851	.00699	.00409
Percent Allowance	15	15	15
Time Allowed	.0098	.0080	.0047

*Based on observation of workers' skill, effort, consistency and working conditions as rated against scale of excellent, good, average, fair and poor. (See text.)

work methods; and (2) Comparative data from other cities, which frequently is not at all comparable because of variations in levels of service or efficiency of administration, or lack of uniformity of local records among the cities.

With time study, it is now possible to establish standards of productivity for each activity without reference to past performance or to inter-city comparisons. Measuring actual employee performance against scientifically established standards will reveal many possible shortcomings: inadequate or faulty supervision; deviation from established procedures; distractions of noise, light or poor ventilation; inadequate training or job preparation; poor layout; and many others.

Time study consists primarily of observing a worker perform a job, and timing with a stop watch each elemental part of the job (walk to refuse can; hoist can to shoulder; walk to truck; dump refuse; return can to former location). Elemental times are adjusted for the worker's skill, effort, consistency and the working conditions to produce an average time for an average worker. This, plus an allowance (generally 10 or 15 percent) for personal delay, fatigue, and unavoidable delay, results in a total allowed time for the job. With this information, it is a simple matter to determine how many of the work units the employee may reasonably be expected to complete per hour, day, week or payroll period. Comparing actual performance to the standard which has been established by time study will produce a useful production index for each worker or group of workers.

Any job involving physical effort can be time studied; however, this technique lends itself best to use with repetitive work such as collecting refuse, typing letters or forms, operating a billing machine, repairing a street cut, sweeping and dusting an office, or overhauling a water meter.

Time study may also be used to determine personnel requirements as in a recent study of janitorial services in a large public building. In this case, two time study men studied the work of several janitors during a full shift for several nights. They recorded the times for almost every cleaning task then being performed. After adjusting these times for skill and effort and allowing for delays, an average time was computed for each cleaning task, such as dusting a desk, table, chair, bookcase, window sill, or radiator, sweeping 10 square feet of floor area, cleaning rest rooms, waxing floors, and numerous other tasks. For ease of use, the unit times developed by time study, which were expressed in thousandths of one hour, were rounded to three decimal places (hundredths of one hour) and the decimal point was dropped, resulting in a simple one or two digit "work unit" value for each item. For example, the average time to dust a desk was determined to be .0187 hours; rounding results in .019 hours, and dropping the decimal produces 19 work units. The work units were then set up on a tabulation sheet. Using the tabulation sheet, it is necessary only to count the number of desks, chairs, and other furnishings, and to measure the floor area to determine quickly and easily the total time required properly to clean each office. With this data, it is no problem to compute the number of janitors needed to clean the entire building.

By this method, it was found that with adequate supervision and with training in efficient work methods 28 janitors could do a more thorough cleaning job than 35 were doing. Prior to the study, the Building Manager pleaded that he needed more than 35 janitors! The estimated savings in payroll cost alone made possible by this one study were in excess of $15,000 per year, many, many times the cost of making the time study. And the building was cleaner than ever before.

COMPUTATION OF TIME ALLOWED PER ROUTE

Elements	*Time Allowed per Occurrence*	*Number of Occurrences*	*Total Time Allowed*
No. 1—Pick up garbage can, carry to truck, dump	.0098	209	2.0482
No. 2—Return can and replace cover	.0080	209	1.6720
No. 3—Walk to next garbage can	.0047	209	.9776
			4.6978
Set Up (Time en route to first stop and return from last stop)			.5260
Total Time Allowed for Route			5.2238

COMPUTATIONS OF COSTS

Components	*Man-Hours*	*Rate/Hour*	*Cost*
1 Driver	5.2238	$1.85	$ 9.664
2 Collectors	10.4476	1.50	15.671
Truck Rental	..	3.75	19.589
Total Man-Hours	15.6714		
Total Cost per Route			$44.92
Cost per Stop (209)			.215

Conclusion

Time study, used in conjunction with methods improvement techniques, provides a new tool for the progressive municipal administrator anxious to improve service and to lower costs by eliminating all types of hidden waste. Performance standards developed by time study are valuable to supervisors as a basis of supervisory control. Almost no city is too small to benefit from this new management tool, whether it is applied by a single employee, a methods department, or by an outside consultant. One final word of warning, time study standards must be analyzed periodically to assure that they remain valid, for they must be based on the work method currently used, and without careful supervision, methods will change and vary as time passes. For this reason, the standards presented in the accompanying tabulations probably would not be completely valid if applied to work of an apparently similar nature in other cities.

WHERE FORCE ACCOUNT WORKS BEST ON COUNTY ROAD JOBS

PAT THOMSON
Douglas County Engineer
Waterville, Washington

THE ENTIRE population, rural and metropolitan, of our county is less than that of neighboring county seats; but we do have space —miles and miles of rolling clay requiring miles and miles of all-weather road. Engineering is a cinch when you can make a survey and say "Put it there" regardless of the cost. No Washington county that I know of is in that glorious monetary position. Most Washington county engineers learn the value of an engineering dollar, or they learn another profession.

Douglas County topography could be termed the typical tundra variety. We have about the same annual precipitation as found in the Canadian Arctic territory, between 8 and 11 ins. per year. We are totally representative of those counties having vast areas (1786 square miles); large road systems (1670 miles); a small population (1400 people); and a relatively small road budget (under $500,000 yearly). The situation is further complicated in that over 50 percent of the population is concentrated in a 25-mile strip along the Columbia River. The remaining 6000 people are scattered here and there over the Big Bend wheat plateau, as is characteristic of any agricultural economy region.

Thus, the road construction necessities vary from the urban 2000 vehicles per day traffic in the river area to the plateau school bus route running 23 miles to serve seven families. And there are only two soil types, a yellowish water retaining clay and solid rock. Rock is a contention on almost every large plateau project, day labor or contract. The very characteristic of a shallow clay soil over solid bedrock creates the high water table essential to wheat production. This same characteristic creates our major construction difficulty. Natural gravel is practically non-existent, with surfacing materials obtained almost solely from shot-rock quarries. The most recent crush and stockpile project (bid Nov. 21, 1955) on 75,000 tons of varied size aggregate went at an average price of $1.10 per ton.

Faced with this tough construction problem, the county road department must get the maximum result out of each tax dollar. Knowing the problem, and being a progressive group, the Board of County Commissioners have gone into a modern operation even further than legality requires. They have felt that the important part of county road department operation was constant management, and that this phase is often forgotten or overlooked. It is, therefore, the duty of the county engineer to control and coordinate the road department under the Board's broad general policy. Thus, the engineer must formulate the plans and specifications for the most efficient operation. The physical activities of maintenance and construction are his direct responsibility, operating under the one-unit equipment rental fund type of system.

Most large bituminous surfacing, all heavy excavation, and some skip-and-jump projects on per mile bids are contracted. Some projects do not lend themselves to contract work readily, being more feasible to do on a force account basis. As in most instances where counties have available equipment, force account work can be accomplished cheaper. These projects are limited to $25,000 total, including engineering. The following are typical of force account accomplished by Douglas County this past season.

A Filling Problem

The Logan Road Fill had its own peculiarities. This is a reasonably heavy traveled farm - to - market, school bus and mail route arterial. The northernmost mile had been constructed several years ago on level ground through a large natural basin. In the light snow years—the dry farming years—this section suffered little or no ill consequence. There was little run-off, and lack of frost gave excellent soil percolation. However, in these late years of early fall freeze-ups and heavy snows, spring run-off and fast drainage have created a lake in the basin, sometimes to a depth of two feet over the existing roadbed—disconcerting to those expecting to travel the road. To rectify the matter and provide an all-weather road it was necessary to construct a four-foot fill for fifty stations and some 23,000 cubic yards of material were required.

Unfortunately, the very feature producing the problem also produced good alfalfa crops in the basin, so farmers adjacent to the right-of-way were averse to side borrow construction. Then, too, this borrow material was a water retaining clay of insufficient bearing quality for the submersion conditions.

The northern end of the project ran into a scab rock ridge, with a scab rock knoll existing about a quarter of a mile further away. Using D7 Caterpillar tractors and 11-yard struck capacity LeTourneau Carryalls, 12-foot borrow ditches were excavated along the scab ridge.

● **SCALPING a crushing pit for borrow. In boulder filled areas the Carryall was loaded with a truck shovel, so cableways on scraper are protected with split pipe.**

Moving into the rock knoll, material soon became quite bouldery, with rocks 6 to 12 ins. in diameter. Consequently, we began loading the Carryalls with a half-yard truck shovel.

Loading through the top posed the problem of earth debris falling into the pulleys and cable runs. To prevent this, the mechanic split 18-in. corrugated metal pipe and welded the half-round sections as protective guards over the cableways. This forestalled pulley jamming and cable fraying with resultant downtime.

The Carryall haul was stretched 2600 feet, the farthest practical limits. Then hauling switched to truck and shovel, using two Michigan truck mounted shovel units and a fleet of five-yard Ford dump trucks. The finished subgrade was surfaced with crushed aggregate for winter settlement.

Reaching the Plateau

Titchenal Canyon exemplifies the difficulties encountered in tapping the various plateau levels. This route leads to the Badger Mountain plateau, some 2000 feet above the Waterville plains. Population is small, with year-around traffic relatively light. However, the fact that Waterville-Alstown wheat elevators provide a faster service and offer a good price differential per bushel created the demand for a harvest haul road; 300,000 to 400,000 bushels of wheat pounding over a road in 150 to 300-bushel loads demand a good solid subgrade of minimum twenty-six foot width with the best possible grade. The only salvation is that the load haul is all downhill, for the best possible grade we can get often means a minimum of 10 percent. The objective, then, resolves into getting as much tangent as possible to allow traffic a free uphill run. This, in turn, may involve several crossings of the canyon channel, creating an acute drainage problem.

In the face of ledge rock cliffs, minimum grade means long fills and solid rock cuts from 7 to 15 feet deep for six to seven stations. Carryalls do not function efficiently in shot rock cuts, for the gates will not close allowing the transportation of a full load. Consequently, in such instances, we used a dozer relay, with one dozer trenching through the cut to the fill junction, the other carrying out over the fill. In larger fills, it has been necessary to use a three-dozer relay. Utilizing this system, material has been transported cheaply and efficiently to 1700 feet.

Drilling Problems

Precipitous rock ledges create a drilling problem. Hand drilling is much too slow; yet the steep slopes do not allow the use of heavy wagon drills. We have found that the three-wheeled, light-framed Ingersoll wagon chuck, using a 30-pound hammer, one inch centerhole steel and carbide tipped bits, operating from a 115 Schramm compressor has virtually solved all our drilling problems. Drillers can get from 180 to 250 lineal feet per shift, depending upon condition of location and type of rock.

(*Continued on page* 185)

● **ROCK cutting; a 30-lb hammer is being used here for drilling. A shallow cut was sufficient on this top-of-a-grade job.**

● **FULL bucket is possible with this front-end loader, even when the material must be taken from below the loader level.**

● **TYPICAL rock cut work; a crawler tractor and bulldozer are taking out blasted rock from a cut about 8 feet in depth.**

● **MOTOR grader is equipped with a highly useful front-end dozer. Here it is being used for blading a widened shoulder.**

APWA News

AMERICAN PUBLIC WORKS ASSOCIATION
1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Report on Annual Meeting of the Board of Directors

The Annual mid-winter meeting of the Board of Directors was held in Chicago, on Friday, January 27, 1956. President Edward P. Decher announced that the membership overwhelmingly approved the changes that were proposed by the Board in the Association's Constitution. The principal change pertains to the make-up of the Board of Directors. The new Board, to be installed at the annual meeting in Ft. Worth, Texas, in September will consist of a President, one Vice President, nine regional Directors and the most recent living Past President. The Executive Director, under the amended constitution, will also serve as Secretary-Treasurer of the Association. Four Vice Presidents, rather than one, were elected under the old constitution which also provided for the election of a Treasurer and four Board Members At-Large. One Regional Director will also be elected from each of the nine geographical regions established by the Board of Directors.

Other important actions taken were: the approval of a $90,000 budget for the current fiscal year; the selection of Kansas City, Missouri, as the tentative site for the 1958 Public Works Congress and Equipment Show; and the establishment of three new committees. One is a Training Committee which was created in accordance with a resolution adopted at the last annual meeting of the membership in Milwaukee, Wisconsin. This Committee will—"explore ways and means of assisting governmental jurisdictions in their efforts to train or otherwise obtain competent persons to fill important positions within their public works organizations." A Street Sanitation Committee was also established to prepare a revised edition of the Association's 407 page book on this subject which was originally published in 1938. The third committee appointed was a Sewer Specification Committee which will prepare an up-to-date edition of APWA Standard Specification J—Sewers.

Progress reports on several projects sponsored or co-sponsored by the Association were also presented to the Board by the headquarters staff. Plans for the 1956 Public Works Congress and Equipment Show to be held in Ft. Worth, Texas were discussed as well as plans for an extensive public agency membership campaign. Other actions taken by the Board will be announced at a later date.

President
Edward P. Decher

Vice-Presidents
Frederick W. Crane — W. M. Swietlik
Kenneth K. King — Albert G. Wyler

Past President
Warren A. Coolidge

Directors
Sol Ellenson — Roy W. McLeese
W. D. Hurst — Jean L. Vincenz

Treasurer
Robert L. Anderson

Executive Director
Donald F. Herrick

Site of the 1956 APWA Congress in Fort Worth

● **FORT WORTH, TEXAS, will be host city for the 1956 Public Works Congress and Equipment Show, to be held at the Will Rogers Auditorium and Civic Center.**

Committees Named For Fort Worth Show

Edward P. Decher, President of the Association, recently announced the appointment of C. M. Thelin, Director of Public Works of Fort Worth, Texas as General Chairman of the Local Committee for the 1956 Public Works Congress and Equipment Show. The Honorable F. E. Garrison, Mayor of Fort Worth was named Honorary Chairman, while W. O. Jones, Past President of the APWA, who is now Manager of Turnpike Engineers, Inc. was named Assistant General Chairman of the Local Committee.

The Chairman of the various Sub-Committees are: J. F. Davis, City Manager, Publicity and Public Relations; Marvin C. Nichols, Consulting Engineer, Management Staff; Emmett M. Race, Manager of Coliseum, Exhibits; O. A. McCoy, Waste Disposal Supt., Inspection Trips; I. C. Driver, Asst. City Manager, Finance; H. H. Hester, Street Supt., Entertainment; E. H. Carter, Consulting Engineer, Housing; W. A. Satterwhite, Jr., Office Engineer, Transportation; W. J. B. Baker, Engineer, Dept. of Public Works, Regis-

Hotel Accommodations in Fort Worth

	Single Rooms	Double Rooms	Twin-Bedrooms	Suites
Hilton Hotel	$4.50- 7.00	$7.00- 9.00	$8.00-10.50	$22.00-50.00
Texas Hotel***	4.00-10.00	6.50-12.00	7.50-12.00	22.50-25.00
Westbrook Hotel	2.50- 6.00	4.00- 8.00	6.00- 8.00	
Worth Hotel	4.00- 6.00	6.00- 9.00	9.00 (few 7.50)	18.00-25.00
Loring Hotel	4.00	6.00	6.50	
Western Hills Hotel	5.75- 9.75	8.00-15.00	8.00-15.50	25.00-50.00
Town House	3.50- 5.00	5.00- 7.00	5.00- 7.00	

***Headquarters Hotel

Motel Accommodations in Fort Worth

	Single Rooms	Double Rooms	Twin-Bedrooms	Suites
Town & Country Motel	$5.00	$6.00- 6.50	$7.00- 7.50	
Desert Village Motel	6.00- 7.00	7.00- 8.00	9.00	(available)
Century Motel	5.00- 6.00	5.00- 6.00	7.00- 8.00	
El Ranchero Motel	5.00	7.00	8.00- 9.00	
Park Plaza Motel	4.00	5.00		

tration; and Mrs. H. H. Hester who will serve as Chairman of the Ladies Committee.

The meeting will be held September 23-26, 1956. While the Hotel Texas has been named the headquarters hotel, the Forth Worth convention bureau has assured the Association of the cooperation of several other leading hotels in the assignment of sufficient rooms for the duration of the Congress. A list of the cooperating hotels together with a schedule of rates appears above.

Send requests for hotel or motel reservations to: E. H. Carter, Chairman, Housing Committee, 1956 Public Works Congress and Equipment Show, c/o Fort Worth Chamber of Commerce, 114 East Eighth Street, Fort Worth 2, Texas.

Chapter Activities

The regular monthly meeting of the **Philadelphia Metropolitan Chapter** was held at the Engineers' Club of Philadelphia on Thursday, January 26th. The program featured illustrated talks on recent fires by Chief Joseph Meskill and Chief Pilot Harry Artis of the Philadelphia Fire Department. Over 100 members and guests attended the January meeting of the **Michigan Chapter** which was held at Huck's Inn in Detroit. The discussion dealt with the traffic and safety features of expressways. The speakers were Roy F. Goodspeed, City Engineer, Ferndale, Michigan, Earnest Davis, Director of the Safety and Traffic Committee of the Automobile Club of Michigan and Edward Gervais, Highway Traffic Engineer of the Michigan State Highway Department. "Refuse Handling" was the subject of discussion at the January meeting of the **Northern California Chapter** which was held in the City of Oakland. Frank Schultz, Field Engineer of the Schultz Materials Handling Corporation of Richmond, California was the guest speaker. An interesting film titled—"Demp-

(*Continued on page* 197)

LOOK at all you can do with a BLAW-KNOX ROAD-WIDENER

- Spread Base Course for Road Widening
- Spread Shoulder Material
- Place and finish concrete without forms
- Spread and finish Asphalt
- Spread any kind of Aggregate

BLAW-KNOX
Dual Compression Trench Roller
Flexible and economical trench roller can roll a minimum width of 20" when rolls are in line. Can also be hydraulically adjusted to roll a maximum width of 39" to increase production by reducing rolling time.

You'll like the Road Widener's ability to handle many different jobs and materials. It's versatility means that you will need a minimum of labor and equipment on any road widening or shoulder job to lower construction costs. Steady high capacity of up to 200 tons per hour keeps jobs on schedule. Tandem drive wheels on all models have power to spare for pushing the heaviest trucks up steep grades. A large hopper, special conveyor belt and hydraulically controlled strike-off gates handle any type of aggregate or asphaltic concrete in widths of 2 to 10 feet and handle concrete in widths of 2 to 6 feet. Hydraulic controls permit gradual widening of a strip around curves when laying aggregate or asphalt. Special vibrator attachment available for all models will permit the placing and finishing of concrete without the use of forms.

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Cleveland "Baby Digger" averages 3,500′ of 22″ x 36″ water line trench daily, digging in clay and rock

R. L. Eatherly of Carthage, Tenn. got good daily trench production with his Model 95 Cleveland "Baby Digger" on this water line contract in the Belshire Subdivision in Nashville. Averaging 3,500 feet per day, the Cleveland cut 4 miles of trench, 22 inches wide by 36 inches deep in curving roadways on a subsoil composed of clay with fairly heavy rock content. The Cleveland's completely unobstructed operator visibility and the convenient grouping and location of its controls for easy accurate digging were definite advantages in cutting the curved trench. Just another example of the outstanding ability of Cleveland Trenchers to *dig more trench . . . in more places . . . at less cost.*

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CLEVELAND

HIGHWAY ENGINEERING IN AUSTRALIA

Patching Sealed Macadam Pavements

WHEN FAILURES develop in the surface of a waterbound pavement protected by a comparatively thin seal coat on a heavily traveled road it is necessary to repair the surface quickly. Over the years, several methods have been used to accomplish this result, but none has been completely satisfactory under all conditions owing to the difficulty of obtaining final consolidation without the patch being damaged by rain before sealing. Recently, however, a very promising method was developed.

Defective areas are dug out, and after any necessary attention to the subgrade, are backfilled with good quality fine crushed rock and well consolidated. If necessary, the fine crushed rock is watered before or during the process of consolidation. After maximum consolidation is obtained, the relatively loose surface of the patched area is immediately primed with bituminous emulsion at the rate of approximately one-third of a gallon to the square yard, and covered with fine granular material at the rate of approximately 1 cu. yd. to 120 square yards. Patches are sealed with cutback bitumen covered with screening in from one to three weeks after application of emulsion.

The emulsion primer has proved sufficient in almost every instance to withstand road traffic for several weeks. Continuous or heavy rain within 24 hours of completing the patch appears to be the greatest factor against complete success.

Raising Multi-Span Bridges

A seven-span bridge 190 ft. long was raised 10 ft. in Australia. This bridge spanned a creek and raising was necessitated by construction of a reservoir and the flooding of a section of the road. Since the route in use was the most desirable one, it was decided to raise the bridge and also to widen it from 16 to 24 ft. between curbs. Work was begun in 1950, suspended from lack of funds in 1951, resumed in early 1954 and completed that year.

Initial stage of the work included driving piles for the wider bridge; constructing columns to the level of the existing deck; driving piles for the jacking towers; and cutting the concrete in preparation for lifting the deck. For lifting the first two spans, weighing 65 tons, 12 jacks were used, two under each side of the abutments and the piers. Later, a 3-span section weighing 100 tons was raised with 16 jacks.

The raising was done by jacking each continuous section in turn. Electric strain gauges were placed on some steel on the bridge which had been bared. These indicated that the maximum stresses developed during moving were of the order of 4500 lbs. per sq. in.

To provide for traffic during the raising, a temporary low-level bridge was built over the creek.

A somewhat similar operation was undertaken on one other bridge. In this case, the decking of the bridge had to be raised 6 ft., but in order to permit raising the concrete columns and placing suitable abutments, the concrete decking was raised 9 ft. 6 ins. and subsequently lowered. This bridge has a single span of 35 ft. with a cantilever span of 12 ft. at either side, making a total length of 59 ft. Decking and supporting rolled steel joists weigh about 170 tons. Four jacking towers were built on either side of the piers, and two 30-ton jacks used on each tower. The bridge foundations were strengthened to permit future widening when necessary.

In lifting, the superstructure was cut from the piers, jacked up and held in position while the piers were concreted, and then lowered in place. Lifting beams, passed under the bridge, were supported on the jacks. The relative levels of the bridge were checked by a series of manometers. Calculations had indicated that a relative movement between jacking points of 0.15 inch would not cause undue strains, and by use of the manometers it was possible to keep within this limit.

Rotary Bar Screen Removes Flats

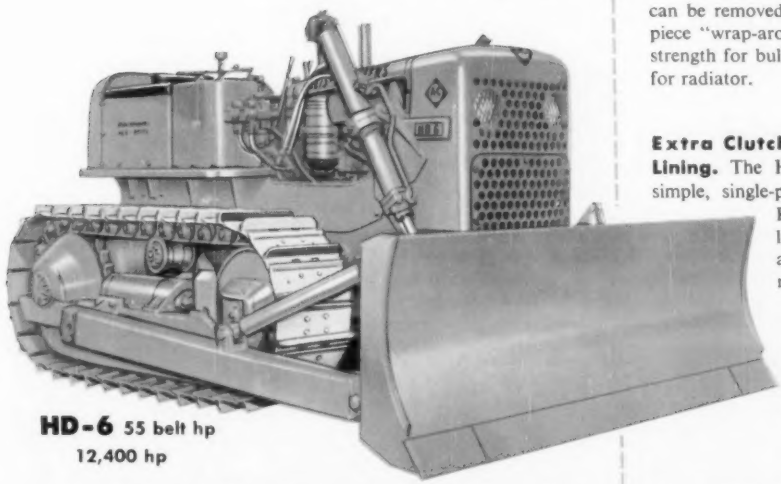
A rotary type bar screen was used to remove flats from uniform-sized ¾-in. aggregate. The screen was 6 ft. long and 4 ft. in diameter, with bars placed longitudinally. Bars were ½-in. diameter, with alternate bars staggered 9/32 in. This gave a 5/16-in. opening between bars. The screen was tilted 5 degrees from horizontal and operated at 18 rpm. Output was 45 cu. yds. per day. The percentage of flats was reduced from 40.7 before screening to 30.2. It was believed that use of a 12-ft screen of slightly larger diameter would increase output to 100 cu. yds. per day and about cut cost in half.

Windrow Spreading Attachment

When a maintenance grader is engaged building up the shoulder adjacent to the pavement, the normal procedure is to take one run through, cutting the shoulder material and depositing a small windrow just inside the edge of the pavement, then to take another run, spreading the windrow material over the shoulder again. This practice is objectionable for two reasons. The windrow material on the edge of the pavement is a hazard to traffic until it is respread and the grader usually has to make two additional trips over the length being maintained in order to spread the windrowed material; one trip to get back into position to avoid working against traffic and the other a working run actually to spread the windrowed material. The Board has developed a windrow spreading blade designed for attachment to drawn maintenance graders; this attachment enables the windrow of cut material to be levelled in the same run as it is cut. The attachment consists of auxiliary spreading blade mounted behind the cutting blade of the grader and is completely under the control of the grader operator so far as depth of spread is concerned. When not in use or when travelling, the auxiliary blade is folded up out of the way. A similar attachment for truck patrol graders is being developed.

The 41st annual report of the County Roads Board of Victoria, Carlton, N.3, Australia, for the year ending June 30, 1954, contains many items of interest. From this excellently prepared report of 90 pages, we have abstracted some items which will be of interest and value to highway engineers everywhere.

This kind of Crawler Tractor Design gives you extra output



HD-6 55 belt hp
12,400 hp

. . . and only Allis-Chalmers HD-6 has it—

advanced design features that combine big performance, versatility, dependability and simplified servicing!

Look at the Allis-Chalmers HD-6—you can see its functional design . . . how it's built to give sure-footed traction, better working balance. But there's more to this crawler tractor than meets the eye—the performance advantages of Allis-Chalmers advanced basic design. It provides more working power, more strength in all components, more working weight where it's needed . . . makes the HD-6 an outstanding performer with drawn or mounted equipment . . . easier to operate and maintain.

Let your Allis-Chalmers dealer show you how the HD-6 can give you that *extra* output on your jobs.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
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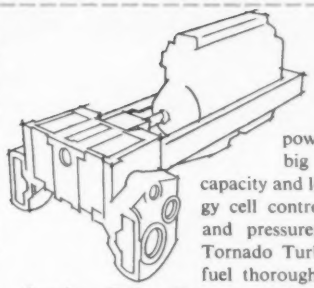
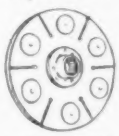


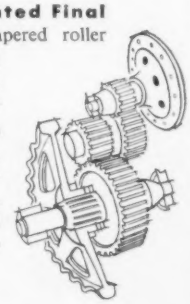
Allis-Chalmers Heavy-Duty Diesel Engine. The HD-6 power plant is designed for big output, ample reserve capacity and low maintenance. Energy cell controls combustion timing and pressures for high efficiency. Tornado Turbulence mixes air and fuel thoroughly for more complete burning. Follow-Through combustion sustains effective working pressures to take advantage of better crankshaft leverage.

Special Strength and Protection. Exclusive all-steel box-A main frame makes possible superior over-all balance, better equipment mounting . . . plus service simplicity of unit construction. Major assemblies like engine and clutch can be removed without disturbing adjacent parts. One-piece "wrap-around" radiator guard provides maximum strength for bulldozer mounting . . . complete protection for radiator.



Extra Clutch Life—with Ceramic Lining. The HD-6 master clutch offers simple, single-plate, over-center design. Revolutionary new ceramic button clutch lining keeps clutch operating longer between adjustments . . . lengthens clutch life . . . reduces lever pull for easier operation.

Straddle-Mounted Final Drive Gears. Tapered roller bearings support both ends of the final drive gear shafts. Smaller gears and shorter shafts (plus line-bored, one-piece case), provide better bearing and gear alignment, more strength, longer life. Double-reduction final drives provide greater ground clearance.



New-Design, Heavy-Duty Track. HD-6 track provides long life under the toughest conditions. HD-6 sidebars have more steel where it's needed . . . benefit from new heat-treating methods which make possible new standards of strength and hardness throughout for extra wearability.

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. . . no other tractor in this size class has them—at no extra cost you get roller bearing truck wheels, idlers and support rollers; 1,000-hour lubrication intervals for truck wheels, idlers and support rollers; 24-volt direct electric starting; crankcase guard; bumper; and lights.

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Street Restoration Procedures

L. F. FLOTRON

Chief Engineer, Bureau of Highways

Dayton, Ohio

THERE are two procedures to follow in street restoration after the excavation for the utility has been completed and the pipe, conduit or structure has been placed in its proper location. These procedures are 1) Backfilling of the trench and 2) Restoration of the pavement.

The type of backfilling of an excavation in a street depends upon the amount of traffic on that street so this has been divided into two parts, namely: Method "A"—Backfill on residential streets and Method "B"—Backfill on main thoroughfares, such as primary or secondary streets or even streets known as a collector street. Our specifications require for all work:

Where sheeting and bracing has been used to support the sides of the opening, it shall be carefully removed as the backfilling progresses. Where the sheeting and bracing has been ordered left in place it shall be cut off two feet below the surface of the pavement. Where the pavement along the sides of the opening becomes undermined and unsupported, it shall be necessary to break down and remove such undermined pavement and the foundation thereof, and it shall also be necessary to remove all loose earth and replace with material properly compacted in a manner as hereafter provided.

The backfilling on residential streets which is known as Method "A", is as follows:

1. The backfill shall be made with material excavated from the trench except that under no condition will soil with an excessive amount of clay, frozen lumps or other unstable substances be used.

2. After the pipe or conduit has been placed, approved backfill material shall be placed in four-inch layers, thoroughly tamped by mechanical means to a plane at least six inches above the top of the structure.

3. Backfill above the level of six inches over the top of the structure shall be deposited uniformly and brought up gradually in layers not exceeding five feet in thickness. Each layer of backfill shall be compacted by the use of water jets at least 1¼-inches inside diameter and of sufficient length to extend to the bottom of the backfill layer. The jet shall be operated with a water pressure of at least 40 lbs. per square inch and in such a manner as to permeate the backfill thoroughly.

4. The backfill shall continue until it has been brought to the subgrade of the permanent pavement.

Method "B", the backfilling of trenches on main thoroughfares is important as it is essential that this type of street be opened to traffic as soon as possible.

1. The backfill around the structure shall be completed the same as mentioned before to a point six inches above the structure.

2. The backfill above six inches over the top of the structure shall consist of well graded bank run gravel with the top size not exceeding three inches in its largest dimension and containing not over 20 percent silt. The bank run gravel shall be brought to a plane parallel to and uniformly 12 inches below the finished pavement and thoroughly compacted by flooding with water. During flooding water shall

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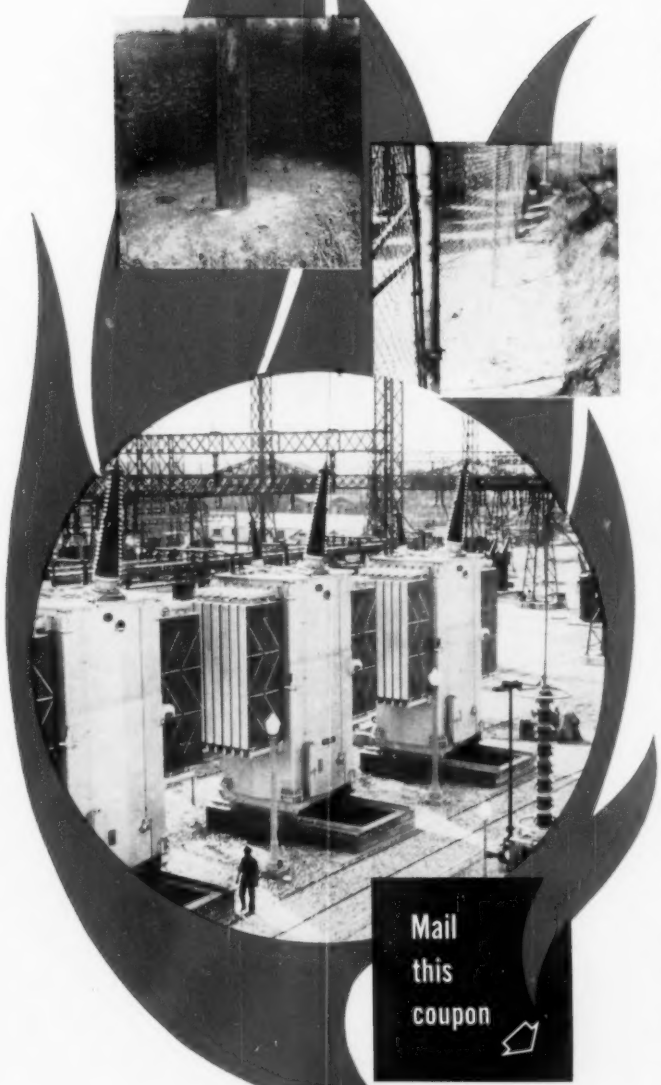

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be allowed to flow slowly into the trench from high points. Sufficient hose shall be provided in order to apply water to the trench at intervals not to exceed one hundred feet.

Tunneling is often necessary to clear another underground facility and the pipe or conduit shall be covered and tamped to a point six inches above the structure. The remainder of the space from the top of this fill to the roof of the tunnel shall be completely filled with 1:12 concrete of suitable consistency, thoroughly tamped to fill the entire space and to afford a rigid support for the tunnel. The concrete shall contain not less than 3.0 sacks of cement per cubic yard. In the installation of small service pipes, it is suggested that the pipe be jacked through or that a hole of sufficient size be bored for the pipe.

Pavement Restoration

In the restoration of the existing pavement surfaces the following classifications have been chosen:

1) Unimproved areas. 2)—a. Gravel roadway and—b. Bituminous surface treated roadway on a gravel or macadam base. 3) Asphaltic concrete pavement (machine paved) on any kind of base (including brick, granite or durax pavements.) 4) Concrete pavements. 5) Concrete walks

In an unimproved area, the method of backfill is that defined in Method "A". This is continued until it has reached the existing surface.

The gravel roadway, which is included with the bituminous surface treated roadway, is replaced as follows: After the backfilling has been completed to a point 12 inches below the finished grade, the opening shall be filled with two 5-inch courses of crusher, pit-run, stabilized gravel with the top size not exceeding 2 inches. Each course shall be thoroughly compacted by rolling or by tamping if rolling is not practicable. The final 2 inches shall be filled in with a pre-mixed bituminous wearing course rolled to ¼ inch above the existing surface course. It may be necessary in some cases to permit the gravel to "road pack" before the bituminous wearing surface is applied.

In the restoration of the machine-paved asphaltic concrete pavement a concrete base shall be constructed irrespective of the kind of base previously existing. This base shall be not less than 9 inches thick, of 2500-lb. concrete. After the backfilling has been completed the material under the edges of the old concrete base shall be dug out to a depth and width of 4 inches. The material then excavated may be used to round up the backfill in the center, so that the bottom of the new base will be arched in form. The concrete shall be thoroughly tamped under the edges of the old base and shall be brought up to within 2 inches of the existing surface of the street. The surface of the concrete base shall be marked or grooved so as to key and prevent displacement of the binder. The pavement shall be blocked from traffic for 3 days at which time the asphalt wearing course shall be laid ¼-inch above the existing grade.

Every effort shall be made to open up to traffic all cuts at the earliest possible moment. As far as it is physically possible to do so, steel plates or wood planks of sufficient size shall protect newly placed concrete.

This is a part of a paper presented by Mr. Flotron at the APWA convention in Milwaukee.

Spring Maintenance That Lasts All Summer

PAT THOMSON
Douglas County Engineer
Waterville, Washington

IN THE LARGEST portion of Douglas County, Washington, the soil is a heavy water-retaining clay of varying depth above solid rock. This characteristic, soil over rock, makes the soil become a greasy gumbo under excessive moisture conditions and causes it to bake almost impenetrably hard under fast drying spring conditions.

This fast drying quality is important in our county road maintenance. Among our sixteen hundred and forty miles of county road there are many miles of gravel and unimproved roads that are farm to market routes serving the wheatland area. These roads are not heavy passenger vehicle routes, but do carry a heavy truck traffic during the activities of seeding and harvest. Maintenance of the unimproved sections must necessarily be limited due to lack of surfacing material. Blading too early does not eliminate rutting and soft spots. Blading too late creates a minor dust bowl of each road. Moreover, heavy patrols carry too much weight for the early softened conditions and if we wait until the soil will carry the weight, it is usually too dry to produce the results wanted. Our problem, for economy's sake, is to work on these roads at just the right period of soil moisture content so that maintenance will produce a smooth even track holding most of the summer. This optimum period is normally of short duration.

Consequently, in the Waterville area of our county we experimented with an Allis Chalmers Model D patrol. This small machine, mounted on 7:50 tires and carrying a ten foot moldboard, has been the answer to our problems. The machine has sufficient weight and traction to drift a good sized maintenance wrinkle and provide a uniform surface.

The "Little Jewel", as we have named it, has light weight coupled with power ability to blade our difficult roads at the most crucial spring period. This provides us with an efficient spring maintenance method that saves us a good many extra dollars because we are able to conduct it at the right time.

● SPRING MAINTENANCE in Douglas County (Wash.) starts before the snow is off the ground. Their Allis-Chalmers Model D grader works effectively on soft roads.

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COMPRESSION in lbs per lineal inch	Empty	Fully Ballasted
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Maintenance on Expressways

CHARLES M. NOBLE

Chief Engineer

New Jersey Turnpike Authority

This is a portion of a paper presented at the meeting of the American Association of State Highway Officials at New Orleans, Louisiana.

MAINTENANCE ON an Expressway is somewhat different from that on local rural roads, not only because of heavier traffic volume and high speed operation but primarily due to the attitude of drivers utilizing the facility. They feel they have the "right-of-way" and are somewhat intolerant of any operations on or occupancy of the roadway. Thus, it is necessary to take a fresh look at maintenance procedures devising and employing special measures when performing maintenance operations on Expressway roadways.

Density and high speed have intensified the necessity for designing maintenance into the modern Expressway so as to reduce occupancy of the roadbed by men and equipment. Mechanization is the order of the day, not only for efficiency of operations and conservation of labor but also to promote safety. Machines, when equipped properly and operated carefully, reduce hazards of maintenance.

The 118-mile New Jersey Turnpike is divided into three divisions for maintenance purposes—49 miles, 42 miles and 27 miles long. The 27-mile section is in the northern portion adjacent to New York. Each of the sections is supervised by a Division Superintendent, and each of the three divisions is divided into two districts. Each district is headed by a foreman. As basic policy, preventive maintenance doctrine is followed.

The maintenance organization operates 258 pieces of equipment which is serviced and maintained at a central repair shop under the direction of a master mechanic. In addition, the automotive equipment assigned to the staff members of the Authority is maintained by the shop and travelling mechanics operate from the central shop. These mechanics inspect the equipment in the field and supervise the operation of division mechanics who perform routine maintenance, greasing and adjustment at maintenance district headquarters.

Because of the large amount of electrical, plumbing and mechanical equipment, including toll collection apparatus, area lighting, air-conditioning, sewage treatment plants, water supply, plumbing and refrigeration equipment, a special mechanical-electrical team functions throughout the Turnpike. A radio engineer and an agronomist complete the staff organization.

Each maintenance task is analyzed to determine whether the work can be effectively done by machine or other mechanical equipment. For example, ice control is handled by salt spread by special one-man operated salt-body trucks, equipped with mechanical spreaders under cab-control by the driver. These units are organized to insure quick action necessitated by the high degree of service required on a turnpike with top efficiency. The salt-body trucks are loaded in eight to ten minutes by mechanical loaders.

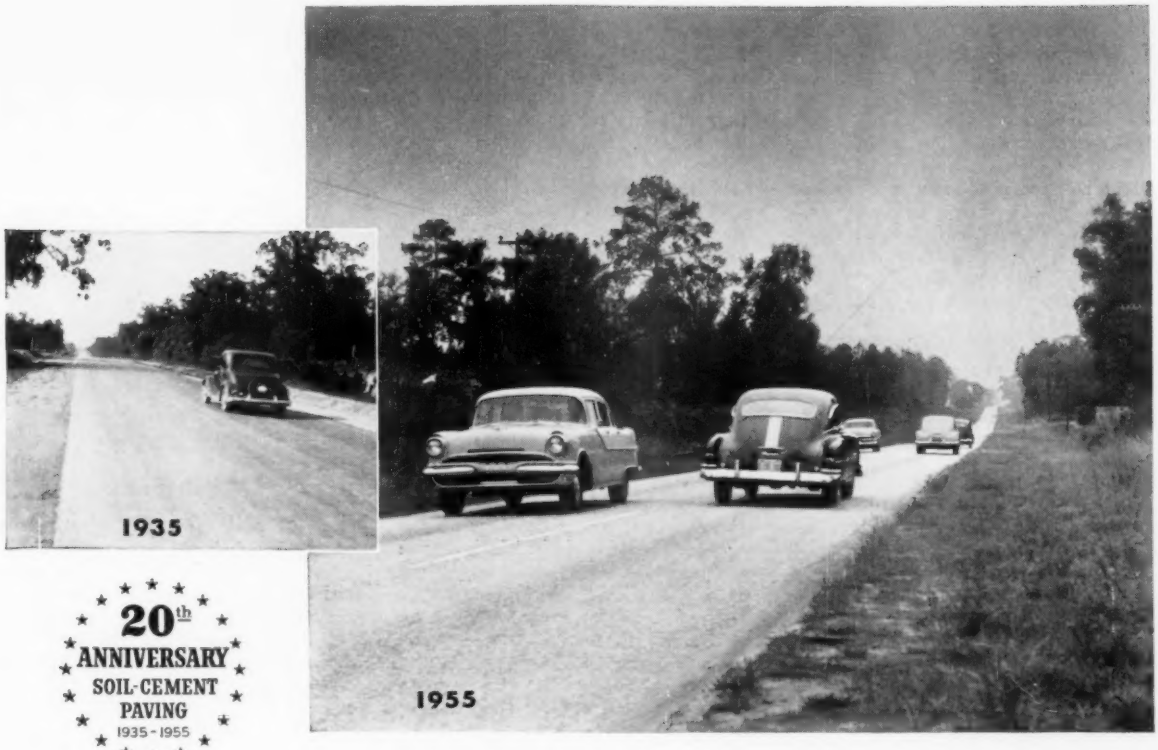
Where standard commercial equipment is not available on the market, special equipment is developed in cooperation with reliable and experienced manufacturers. Such special equipment includes a high level electric light service truck to handle the 30-foot high pole bracket arm aerial lights; a truck mounted machine for traffic paint line marking which will lay two 6-inch lines of paint simultaneously, 12 feet apart; and a flossing machine for spraying lime, fertilizer and grass seed.

In the design of the Turnpike, preventive maintenance to as great a degree as feasible, was originally designed into the facility and included in the construction contracts. High quality, tough and durable pavement that requires a minimum of surface maintenance was utilized. Hard surface shoulders flanked by a 6-foot grass berm eliminates the necessity of scraping or blading, a practice which would have been almost prohibitive under the heavy traffic experienced on the Turnpike. Side slopes to ditches are limited to 4-to-1 and no slope is steeper than 2-to-1. All slopes and disturbed areas are top soiled, fertilized, limed and planted with grass seed. Clearing was carried back sufficiently to avoid falling trees encroaching on travel lanes. Drainage pipe systems were designed on the self-cleaning principle with a minimum velocity of 3-feet per second when flowing one third full. All wooden guard posts were treated to retard rot.

In a number of instances, minor fill settlements have necessitated an overlay of asphaltic concrete to fill depressions in the roadway pavement. Because of high standards on the Turnpike and the desire to furnish unexcelled transportation service, special procedures have been developed for this overlay work. The procedures are utilized to restore the original high degree of smooth riding quality, retain original non-skid properties, provide high stability against distortion and shoving and provide substantially the same texture, color and appearance as the adjacent pavement. The above is accomplished by a close approximation of the original gradation of the stone and fine aggregates, adherence to the original design mix, utilization of the same aggregates used in the original mix to achieve reasonably close color matching and use of machine laying whenever feasible, reducing hand laying to the absolute minimum. An engineering survey party takes profiles, and new grades are laid. The survey party sets stakes or pins and wire guides are used to assist the spreader operator.

All maintenance operations conducted within the roadbed (from shoulder to shoulder) are surrounded by safeguards to reduce the chance of accidents to the absolute minimum, particularly those involving patrons. For example, all pavement traffic paint lines possible are placed with a large truck applicator. Following immediately behind the applicator is the supervisor's truck and behind that is a truck placing traffic cones, at 50-foot intervals. This truck has an 8′x3′ "CAUTION MEN WORKING" sign. At the beginning of the operation where the paint has dried is a fourth truck on which is mounted an 8′x6′ sign with letters ranging from 12″ to 20″ high with the message "SLOW—KEEP OFF WHITE LINE—KEEP RIGHT (OR LEFT)—35 m.p.h.". In addition the two preceding signs have red flashing blinkers mounted on them. At the beginning of the entire operation is a stationary sign 6′x4′ with 10″ letters reading "SINGLE LANE—4 MILES".

These trucks and signs following the paint truck not only protect the crew on the paint truck but, importantly, reduce the chances of rear end collisions even in the case of somnolent drivers since the at-



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The three small photos at the right show part of the 20th anniversary celebration. Specimens of the pavement were removed for scientific study. When the samples were placed in a compression testing machine they were found to have a compressive strength of 922 lb. per sq.in. Back in 1935 samples tested 480 lb. per sq.in. These tests prove once again that soil-cement pavement actually grows stronger with age.

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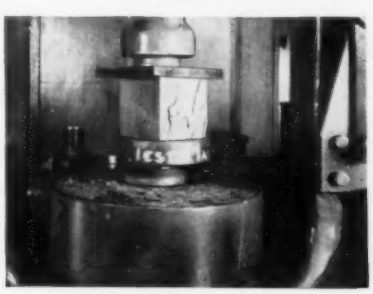

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tention getting signs are visible for approximately a mile ahead.

The "following truck" principle is also utilized when mowing the raised grass median. Here a gang of rotary mowers will cut the full 16-foot grassed portion in one pass. However, at the center bridge piers, it is necessary to encroach on the inner shoulder when passing to one side of a pier. The following truck not only protects the tractor-mower operation, but also warns motorists not to stray into the inner shoulder at that point.

Roadway lighting fixtures are maintained from a special high platform truck parked on the shoulder except on the Hackensack and Passaic River bridges, which have no shoulders. Here it is necessary for the "high" truck to park on the outside live lane when changing lighting elements. In these cases a truck with a sign is stationed several hundred feet to the rear, yellow painted rubber cones set out and a flagman stationed ahead of the outpost truck to direct traffic around the obstruction.

On resurfacing operations where it is necessary to fill depressions in the pavement surface due to fill consolidation, elaborate precautions are taken. Only one lane is worked at a time, which in the two-lane roadway reduces traffic to one lane in that direction of travel. A mile in advance of the actual operation, a large sign warning of construction ahead is set up to one side of the lane to be shut down. From this sign and on past the scene of the work, a row of yellow rubber traffic cones is placed at about 75-foot intervals. Additional signs are used, each gradually encroaching into the lane until the final sign completely blocks the lane being worked on. From one to three flagmen are utilized depending on the prevailing conditions at the site. Particular care is taken over crests that the advance warning sign is placed on the leading side of the crest. Upon completion of one lane, the signs, cones, spreader and crew shift over to the adjoining lane in order to get a hot joint with the previously laid asphalt. Work on the pavement usually can not be started until about 9AM and must usually terminate by 4 PM otherwise the traffic tie-up would be intolerable. If work is attempted beyond those hours more traffic than can be handled by the restricted roadway causes back up and stoppage of vehicles, which is an invitation to rear-end collisions. This elaborate set up and flagging service costs money but it is well worth while when viewed from the standpoint of public safety.

There is evidence of drivers who continue driving on the road after reaching exhaustion and who drive in a state of somnolence, often actually dozing at the wheel. Although the police are constantly on the alert for these drivers, nevertheless enough of them remain undetected to be a menace. Therefore, maintenance operations must be planned and safeguards set up in anticipation that a driver may drive straight into a stopped vehicle, sign or other object in the road. Flagmen, for example, must stand clear of signs and barricades since they would be endangered by flying pieces and they must always stand facing traffic, watching each approaching vehicle, constantly on the alert. Any operations that encroach on pavement and shoulders must be protected by large signs, traffic cones and flagmen.

The precautions to be observed by maintenance forces and contractor alike were outlined in briefed excerpts from traffic regulations to contractors issued April, 1952. These and excerpts from Turnpike widening contracts accompanied the paper.

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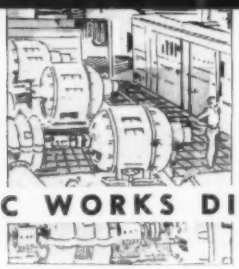

PUBLIC WORKS DIGESTS

THE WATER WORKS DIGEST

Remote Control In Operation

In water works operation, remote control can be applied to flow rates in main distribution lines, raw water supply lines, etc.; levels in reservoirs; pressure in distribution systems; pump valve and circuit breaker operations; and chemical feeder rates. A manual remote control system consists essentially of a control switch and a two-wire circuit and relay by means of which a pump can be started or stopped. To be sure this has happened, a report-back function must be added, which may take the form of a telemetered quantity such as flow, pressure or level, or pilot lights may be lighted. With a report-back added it becomes a "supervisory control." The authors describe the equipment available for securing such control, its operation and possibilities.

The transmission lines used are often rented from a local telephone company, with rental charges based on a single transmission circuit. The city of Houston, Texas, which operates a telemeter monitoring system, believes that the cost is justified because of the more reliable and improved service resulting from its use. An elaborate system at Dallas, Texas, which controls a group of widely scattered pumps, valves, tanks and reservoirs, will, it is estimated, repay its original cost in four years, and thereafter show a profit of approximately $16,000 a year in salaries and cost of truck operation. By supervisory control it is possible to monitor such functions as turbidity, chlorine control, pH, etc.

"Remote Control in Water Works Operations." By B. L. Soscia and M. E. Rogers, Builders-Providence, Inc. PUBLIC WORKS, February.

Enormous Losses Due to Inaccurate Metering

New York City in 1953 had 192,000 meters on water services. An investigation revealed that worn and oversize meters were mainly responsible for under-registration of about 40 mgd, representing a revenue loss to the city of $3,000,000. More than 70% of this loss occurred in meters 1½ inches and larger. The engineers making the report recommended a program of meter testing, beginning with the 28,000 meters of 1½ in. and larger. At present meters are tested only when they fail to register or indicate a noticeable decrease in consumption. After this the program should include testing 6-in. meters and larger once a year; 4-inch meters every 2-yr.; 3-inch once in 3 yr.; and 2-in. or smaller once in 4 yr.

"More Meter Tests Urged for New York City." *Water Works Engineering*, January.

Water Policy Committee's Recommendations

In a report to Congress, the President presented proposals for modernizing and coordinating federal water resources policies. These include creating a sort of "water czar" and a board of project review, but leaving final project authorization with Congress. Federal efforts at collecting hydrologic data should be doubled. There was no recommendation to strengthen the Water Pollution Control Act; to impose a uniform priority system over the nation, or to affect local water laws, except to urge groundwater control.

"Eisenhower Unveils Water Policy." *Engineering News-Record*, Jan. 26.

Head Loss In Butterfly Valves

The advantages of butterfly valves — space saving, simple operating mechanism, and low cost—are partly offset by the head loss, which, in full open position, is slightly larger than that of other valves; and also by the small amount of leakage which is inevitable in valves without special seats. The author presents a chart which gives the head loss factor for each angle of butterfly valve opening and different velocities of flow.

"Head Loss in Butterfly Valves." By H. W. Hamm, S. Morgan Smith Co. *Water & Sewage Works*, January.

Large Wrought Iron Pipe for Water Development

The recently constructed Bayou Lafourche Pumping Plant Project at Donaldsonville, La., is part of Louisiana's water resources development program. It will help satisfy water requirements along Bayou Lafourche from the Mississippi River at Donaldsonville to the Gulf of Mexico. Water from the Mississippi River will be pumped into the Bayou Lafourche. The bayou, an old arm of the Mississippi, has been leveed off from the river since 1903.

More than 5,000 feet of 60-inch and 48-inch pipe, fabricated of Byers wrought iron plate, is employed for intake and discharge lines; most of the plate is from 5/16 to ½ ins. thick.

A portion of the lines are supported above ground, with the remainder of the installations below ground at depths of four to six feet. Some of the intake lines were launched at the shipyard of Avondale Marine Ways and floated to the site of installation.

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This assembly consists of two 4-in Rockwell single register compound meters, four Fig. 143 Nordstrom valves and two 8-in reducing manifolds. The over-all laying length conforms to A.W.W.A. standards for 8-in compound meters.

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An 8-in compound meter is a heavy, bulky piece of machinery. Installation is always a major problem and service a headache. You'll save time and effort—earn greater revenue by using two-meter Rockwell manifold assemblies. *They measure all the flows* with greater accuracy than a single big compound. And the complete assembly weighs approximately 100 lb less. It only takes *two* men to install.

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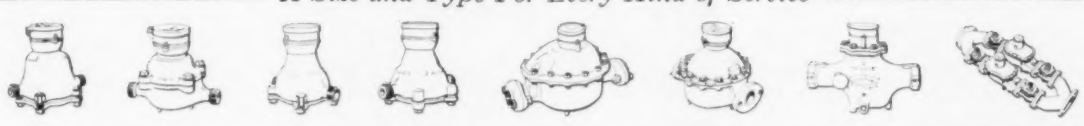

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Air Operation Of Flow Controllers

This article describes the controlled air pressure actuated and operated control and gauge equipment installed in the new filter plant at Austin, Texas, known as Infilco's C-A-P system. The general principle on which the system operates depends on converting liquid levels and rate of flow values to a controlled air pressure which is proportional to the liquid level or rate of flow; which air pressure is used to actuate gauges or control the opening of valves through the use of air motors or motor devices. This use of air pressure eliminates stuffing boxes, mercury chambers and cables, and assures positive reaction to the changes of flow or level. The system as used at Austin has been in operation about a year and a half; it has been completely trouble free and has given perfect control of the filters.

"Air Operation of Flow Controllers and Gauges in Austin's New Plant." By A. A. Kalinske, Infilco, Inc.; and A. H. Ullrich, Supt. of Water & Sewage Treat., Austin. *Water & Sewage Works,* January.

Thawing Main with High-Pressure Steam

In Norridgewock, Maine, the water district, in carrying an 8-inch asbestos cement water main across the Kennebec river, suspended it from hangers on the side of a concrete bridge. It was placed late in November, insulated and with a ¾-in. blowoff near each end of the bridge. Soon after installation, when only four domestic services were receiving water from this line, the pipe froze. To thaw it, one of the blowoffs was opened to drain out the unfrozen water, and a steam "Jenney" injected live steam through this blowoff under 105 lb. pressure. In 20 minutes the main was thawed. The blowoff was left open to maintain flow through the pipe, and it did not freeze again.

"Frozen Asbestos Cement Pipe Thawed with High-Pressure Steam." By J. Elliott Hale, Supt. *Water & Sewage Works,* January.

Cold Delays Softening Reaction

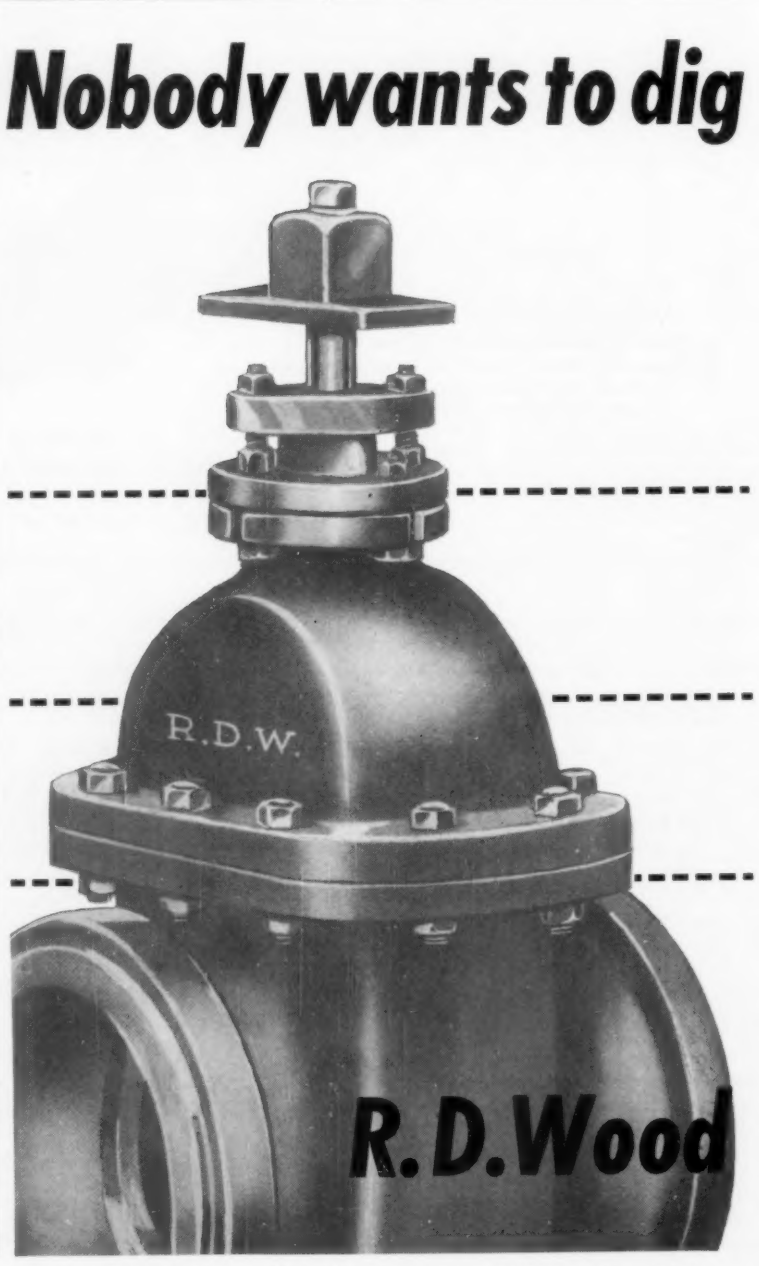
At St. Paul, Minn., the temperature of the water as it enters the softening plant averages 2° to 4° C during the six colder months, and 17° to 20° C during the six warmer months. In general, the water is harder in winter than in summer. It has been noticed that the softening process slows down in winter, and a study has been made of this phenomenon. It was found that water treated at 20° C was reduced in hardness from 170 ppm to 72 ppm in 20 minutes reaction time, and to a low of 58 ppm in 60 minutes reaction time. Treated at 10° C, the reaction times were 60 and 110 minutes respectively. When the water temperature was 2° C, the hardness was reduced to 71 ppm in 90 minutes, and to 68 ppm in 138 minutes. Since the reaction time practicable depends upon the capacity of the plant, the time necessary for obtaining the desired reduction in the coldest weather should be considered in planning a softening plant.

"Cold Weather Materially Slows Water Softening Reaction," By Ross A. Thuma, Supt. of Filtration. *Water Works Engineering,* December.

Other Articles

"**Activated Silica:** Its Laboratory Preparation and Evaluation in Water Treatment Processes" in England. By J. G. Walker. Water and Water Engineering (England), December.

"Thirteen Water Systems Supply Rural **Oahu,** Hawaii." By Jacob Chu,



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Eng. Suburban water system, Honolulu. Water Works Engineering, December.

"Treatment of Water by **Storage.**" Part of a manual on Laboratory Control. By F. W. Gilcreas, Prof. of San. Sci., Univ. of Florida. Water Works Engineering, December.

"Water is Building Another County." **Cobb County,** Georgia. By Guy Browning Arthur. Public Works, February.

"**Dams.**" A description of the various types, and the selection of that most suitable for a given location. By. G. M. Binnie, President, Inst. of Water Engineers. Contractors Record, Jan. 4.

"Brand New Water System for Brand New **Levittown, Pa.**" By Malcolm Merritt, Jr. Water Works Engineering, January.

"Over $300,000,000 Reported as Needed to Give **Chicago Area** Adequate Water." Comprehensive report by consulting engineers. Water Works Engineering, January.

"**Coagulation** of Water." Manual on laboratory control by F. W. Gilcreas, Prof. of San. Sci., Univ. of Florida. Water Works Engineering, January.

"Water Supply **Progress in 1955.**" By Frank C. Amsbary, Jr., Pres., Am. WW Ass'n. Water & Sewage Works, January.

"Modernized **Accounting and Service** Procedures" of the Div. of Water and Sewers of Phoenix, Ariz. By Stanford I. Roth, Collection Supervisor. Water & Sewage Works, January.

"**Mixing and Sedimentation:** Water Works Practice," the 26th installment. By George E. Symons. Water & Sewage Works, January.

"Designing, Constructing and Maintaining **Centrifugal Pumps:** Part 9, Mechanical Seals." By Roy Carter and Igor J. Karassik, Worthington Corp. Water & Sewage Works, January.

"**Rainfall in Maine.**" Records by months for the past 9 to 16 years at 42 stations. Jour. New England WW Ass'n, December.

• • •

Water Company Compelled to Move Water Lines at Own Expense in Highway Improvement

The State Highway Commissioner of Virginia brought proceedings to adjudicate his rights with respect to lowering the grade of a road as against the rights of the village water company to occupy the subsurface of the road with its pipe line.

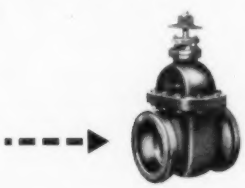
The plans called for a lowering of the present grade in places below the level of the pipe line. The water pipes had been installed under easements granted by owners of the underlying fee in the road, to the water company's predecessor in title. The issue in the case was whether the pipe line had to be removed or relocated at the expense of the Highway Department or of the Water Company.

The trial court was of the opinion that the easement of the Water Company constituted property which could not be taken without the just compensation requirement of the Constitution being satisfied. The Supreme Court of Appeals of Virginia here held that the right of the State Department of Highways to change the grade in order to make it safer and more convenient for public travel was superior and reversed the lower court.

The court reviewed several cases and stated that they were of the opinion that upon acquiring a right-of-way for a road the public right was not narrowly limited to passing over the surface as then made. The public easement was coextensive with the limits of the highway and the public right was not limited to the surface of the highway but extended both upward and downward for a

up gate valves

Reliability is the important consideration in gate valves. They have got to work and *keep on working* even after years of idleness in the lines. Digging them up for repairs is too costly—as well as a possible fire or health hazard while they are out of operation.



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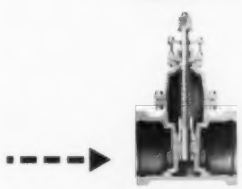

Simple in Design

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Only Three Moving Parts

Just a spreader and two discs—no small wedges or delicate parts.

Revolving Discs

One of the secrets of Wood gate valve reliability is that the discs are hung loosely. They are free to revolve their complete circumference while being raised or lowered. There's no dragging of the faces to cause wear at one point.

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distance sufficient to accommodate as well as to protect all proper uses to which the way was subjected. The owner of land who had dedicated it to the public for a road impliedly granted the attendant or incidental right to make such use of it as should suitably fit it for travel as circumstances changed. The rights of the owner of the underlying fee are always subordinate to the rights of the public and may grow less as the public needs increase. With this exception the owner retains all that is not needed for public use. He could convey to another the right to lay a pipe under the bed of the road, provided he did not thereby obstruct the road. However, the court stated, a change in the highway which tended to make it more useful for public travel and burdened the fee in the manner contemplated when the road was laid out but to a greater degree was not an additional servitude upon the fee.

It was not contended that the proposed change of grade was either unreasonable or unnecessary and it was to be made wholly within the original right-of-way. Thus the court held that the Virginia Department of Highways had the right to change the grade of the road in question, which right was superior to the right of the Water Company to maintain its pipe line where it would obstruct the alteration, and that the pipe line had to be relocated at the expense of the Water Company so as not to obstruct the superior right of the State Highway Commissioner to make the proposed improvement.

• • •

Improving Activated Sludge Treatment at Davyhulme

THE DAVYHULME Sewage Treatment Works of Manchester, England, consist of a number of plants. In addition to primary sedimentation and storm water treatment facilities, there are three activated sludge plants and a large area of contact beds—46 acres of primary and 39 acres of secondary beds. The daily average volume of sewage flow for the year ending March 31, 1955, was 69.748 mgd (Imperial), from a population of 834,000, or 84 gpcd. Excess storm flow is held in special storm water tanks, settled and discharged, the flow to the treatment works being controlled to a volume which can be given treatment in the regular units.

During the year covered by the report, 18.1 percent of the flow (12.598 mgd average), was settled in storm water tanks; 21.3 percent (14.881 mgd average) was settled in sedimentation tanks and discharged without further treatment; 30.7 percent (21.397 mgd average) was treated by primary sedimentation and primary and/or secondary contact beds; and 29.9 percent (21.048 mgd average) was treated by sedimentation and activated sludge in the three activated sludge plants.

The report devotes special attention to the activated sludge plants and, in particular, to a smaller plant recently equipped with Simplex High Intensity Cones. This plant treated an average of 2.17 mgd. The main and largest plant, put into service in 1935, is of the diffused air type and treats about 18 mgd. A bioaeration plant, using mechanical aeration, treated an average of 0.86 mgd during the year.

The Simplex equipped plant, on the basis of test runs during March and April, 1955, treated 1.71 mgd settled dry weather sewage with an average BOD of 229 ppm and produced an effluent averaging 18.1 ppm with an aeration period of 9.6 hours. This was a better effluent, produced with a considerably shorter aeration period, than could be ob-

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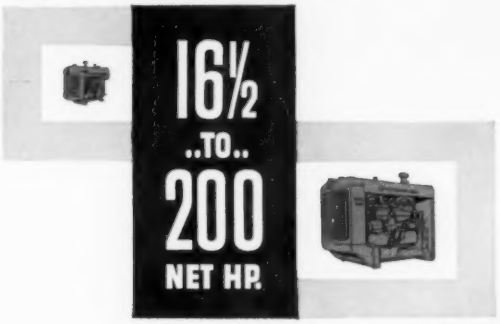

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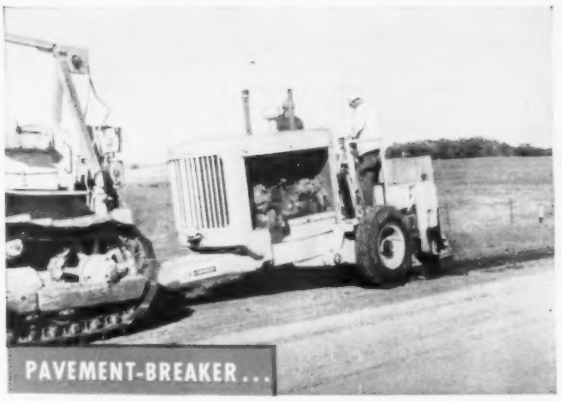
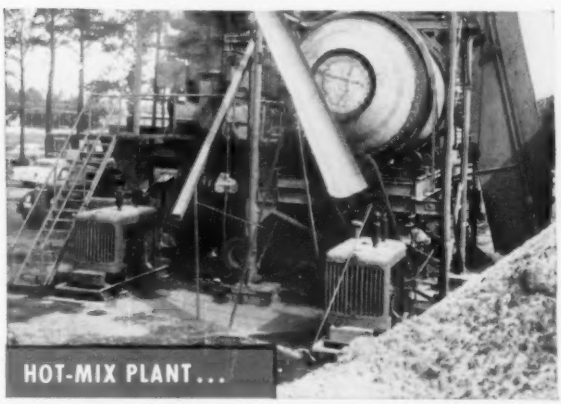


This UD-24-powered preparizer chews up 2 miles of 24-ft pavement per 8-hour day for Contractor G. A. Watson, Barneveld, Wis. He says, "My equipment is International-powered because International engines are dependable, and backed by a company that gives service when needed."



Nello L. Teer Co, Durham, N. C., powers this hot-mix plant with an International 190 hp UD-24 on the tower, another UD-24 at the dryer, and a 125 hp UD-18A on the fan. Plant output on U. S. Hwy 13 job in Maryland averaged 1,000 tons per 10-hour day.

City of Danville (Va.) replaced original engines in two ½-yd shovels with 75 hp UD-350's. "These IH engines sure cut operating costs," says Works Director H. Bowling. Each shovel uses only 17 gal of fuel to produce 95 five-yard loads per day.

In 12,000 hours work over 7 seasons, the 190 hp UD-24 powering Sheboygan County's crusher has needed only one overhaul. It produces 700 tons of crushed stone per average day. "Most dependable engine we know of," says the pit superintendent.

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tained from either of the other two activated sludge plants. For the entire year, the Simplex plant operated with an average aeration period of 7.4 hours, treating 2.17 mgd, and producing an effluent with a BOD of 19.7 ppm. It did this with a horsepower expenditure of 24.3 per million Imperial gallons.

In regard to this plant, the report states:

"Toward the end of May, 1954, adjustments to the new High Intensity Cones fitted to the Simplex surface aeration activated sludge unit were finally completed by the makers and from that time the installation has run without a single stoppage . . . The average daily volume treated during the year by this system was rather more than 2 million gallons, or just about twice the daily volume treated in the same plant during the year 1953-54. The average quality of final effluent produced was rather better than that of the previous year and complied with the Royal Commission recommended standards. The average horsepower requirement per million gallons of sewage treated was 24.3 which was some 14 percent less than for the previous year . . . During spells of dry weather it produced a satisfactory effluent when dealing with 1,710,000 gpd. The average detention time was between 9½ and 10 hours and the horsepower required was 28.8, which was considerably less than that of either the diffused air or bioaeration units.

"Compared with the performance of the Simplex plant in dry weather periods before the new cones were fitted, it is apparent that the unit is able to treat about 70 percent more sewage, and at the same time to produce a more satisfactory effluent while requiring less horsepower per million gallons. Another satisfactory feature of the Simplex plant, not revealed in the analytical figures, is that the flow of sewage fed to it can be easily made to fluctuate according to the way in which the main flow entering the Works varies. This practice has been followed since May, 1954, and therefore the results produced represent what could be expected from a plant treating a much larger proportion of the total flow . . . .

"Foam produced. . .on the Simplex plant has been confined mainly to the corners of the aeration pockets situated toward the outlet end of each line of cones and has not been troublesome."

• • •

Retirement Officer Wanted

The City of San Diego, California is accepting applications for the position of a Retirement Officer. Age 21-52, inclusive; education and experience equivalent to graduation from college with major work in business administration and three years of business management experience, including accounting, actuarial or personnel experience are required. Duties will include managing the affairs of the City Employee's Retirement System, planning and implementing an employee information program and administering the disability retirement program. Salary range is $438-$532. Applications may be obtained from Civil Service Commission, Room 453 Civil Center, 1600 Pacific Highway, San Diego, Calif.

• • •

Parking Meter Revenues in Toledo

Parking meter revenue in Toledo, Ohio, in 1955, amounted to $204,035.15, an increase of about $45,000 over the preceding year.

1. Large illustration shows Singl-use Fiberform ready to be filled.
2. Filling plate and collar simplify pouring concrete into form.
3. Completed meter box barrel.
4. Meter box with cover in place.

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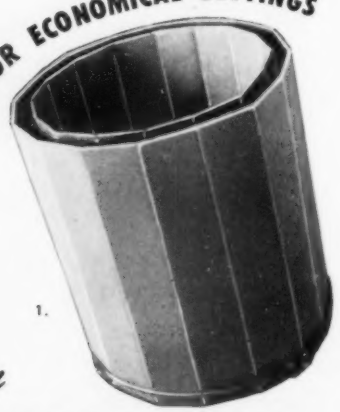

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1955 Progress in SALINE WATER CONVERSION

THE PAST year's researches under the Saline Water Conversion program of the Department of the Interior pointed to a number of future possibilities and prospects. These are listed by David S. Jenkins, director of the program, in his report for 1955 as follows:

(1) Distillation shows much promise of attaining considerably lower cost levels. It is anticipated that fullest utilization of very high heat-transfer rates will be productive. Combination processes within the normal temperature range of distillation, as well as work in the critical range of salt water, require further study. Scaling has proved to be a formidable difficulty. For research into both distillation and scaling control, experimental work on actual sea water at a seashore location is essential.

(2) The performance of membranes, both electric and osmotic, is noteworthy and justifies continuing support. The investigations of the past two years reveal the possibility that fuller work in both laboratory and pilot-plant research will result in greatly improved performance and lower water costs.

(3) Developments in solar distillation are encouraging, and warrant additional work to bring this means of utilizing low-cost energy nearer to practical serviceability.

(4) Freezing processes have inherently low cost if a rapid and economical method of separating the pure ice from the mother liquor can be developed.

In addition, it is apparent that several processes not yet fully explored, including chemical, physical and electric, need to be followed to definite conclusions.

A growing need exists for a small desalting unit of household size for the many seashore homes and cottages in the United States, for irrigation of small truck farms along sea coasts in many parts of the world, for improvement of farm water supplies, and for possible civilian use in emergency conditions.

Costs and Cost Estimates

While the 1955 work demonstrated that development of low-cost conversion methods is making progress on laboratory scale, accurate translation of the results to plant-scale dimensions and precise production-cost figures is not feasible at this time. In general, it must await pilot-plant testing and the design of full-scale production plants for bases of estimates. Production-cost estimates contained in the individual project reports are those of the researchers or investigators and must be presumed to reflect the optimistic views natural to a proponent.

The most promising processes so far developed appear to be able to produce fresh water at costs comparable with the maximum present costs of industrial water supplies. Such maximum costs, however, prevail only under exceptional conditions of service, and any extensive use of freshened saline water is dependent on reducing present production costs.

It is clear that a number of years of intensive effort will be required before a cost level can be attained that will make converted saline water economically available for most purposes. Pilot-plants will have to be built and operated before water costs can be realistically determined.

The pilot-plant vapor-compression still now under construction is believed to be one necessary forerunner of other pilot-plants from which the conditions and costs of practical production by that process can be determined with fair reliability. Construction of a medium-size pilot-plant solar still has been proposed and is under consideration. The past year's operation of the pilot-plant electric membrane field-test installation, while in many respects highly encouraging, disclosed difficulties of the type likely to attend any operation of the kind, such as lack of definite determination of maintenance costs, and unknown production costs of a plant of working size. A larger and improved plant may have to be built and operated to furnish a basis for reasonably definite estimates.

In view of the vital importance of the cost factor to the practical application of dimineralization, and the variety of cost estimating methods and assumptions used by various manufacturers and investigators, attention was given during the year to the problem of standardizing cost determination. The development of a code of basic data and assumptions was initiated and well advanced during the year.

A special problem arises in comparisons between the cost of converted water and the cost of diverting and supplying naturally fresh water. Many estimates of the cost of supplying fresh water, particularly for large irrigation projects, necessarily include modifying assumptions that operate to reduce the actual over-all costs. It is evident that in any comparisons, care must be taken to use only real total costs.

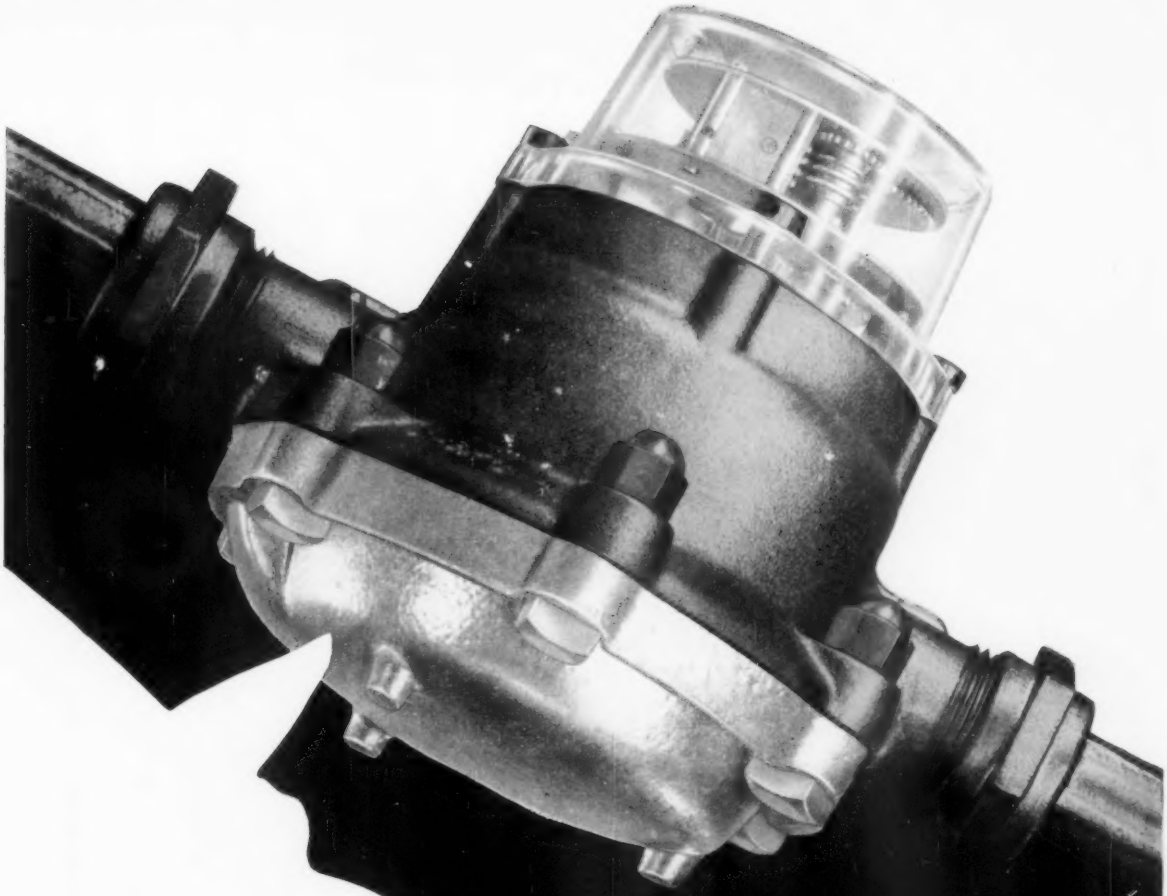
Special Problems

Translation of processes for demineralization of saline waters to large-scale service presents some practical questions distinct from the scientific and technical problems included in the research studies. Brief reference to three of these is appropriate.

Sea Water and Inland Conversion—The essential differences in governing conditions between sea coast and inland locations for conversion plants, and the fact that some processes are better adapted to one than to the other location, suggest that conversion processes should be divided into two distinct groups. On present showing, distillation processes are well adapted to sea coast use, while selective-membrane processes seem better adapted to inland regions. It appears probable that economy may favor large central plants at sea coast sites and relatively small local-service plants at inland sites, although both large and small units will be in demand in both locations.

By-Product Disposal—Costs and operating systems of demineralization will be complicated by the problem of waste disposal at inland plants. In the case of certain processes, the value of byproducts produced at the conversion plant may tend to reduce the water cost. Similarly, under certain conditions, by-product power generated by steam used for process heating may have market value. On the other hand, in inland areas the problem of waste disposal will require considerable study and may increase costs materially.

Hard Waters—The organic act clearly relates to the development of means for producing suitable water from saline waters, without restriction as to the kind of treatment. The Department's research work to date has been concerned largely with demineralization or the removal of salt from water. However, the extensive occurrence of various substances that cause hardness in water suggests that improvement of means of water softening may be a valuable associated or separate result of the research investigations.



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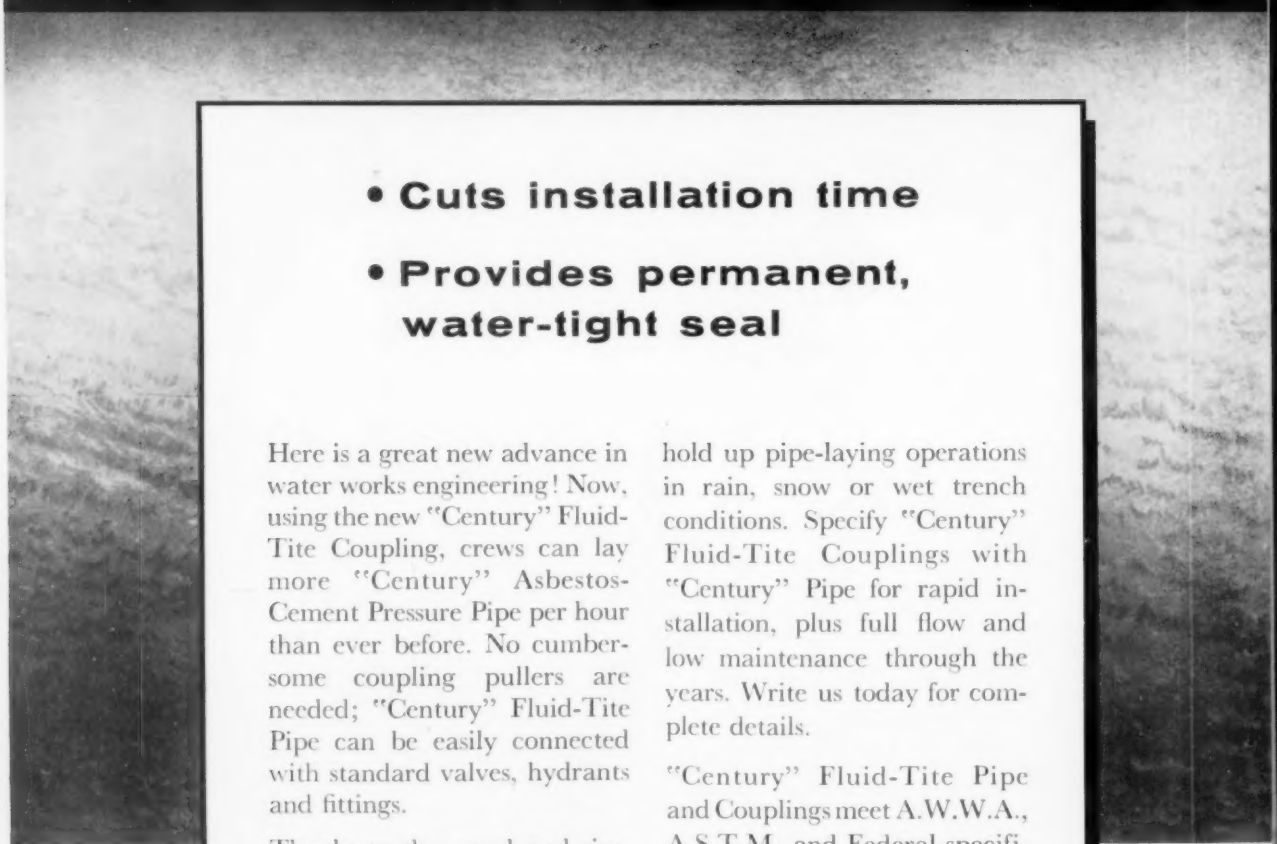

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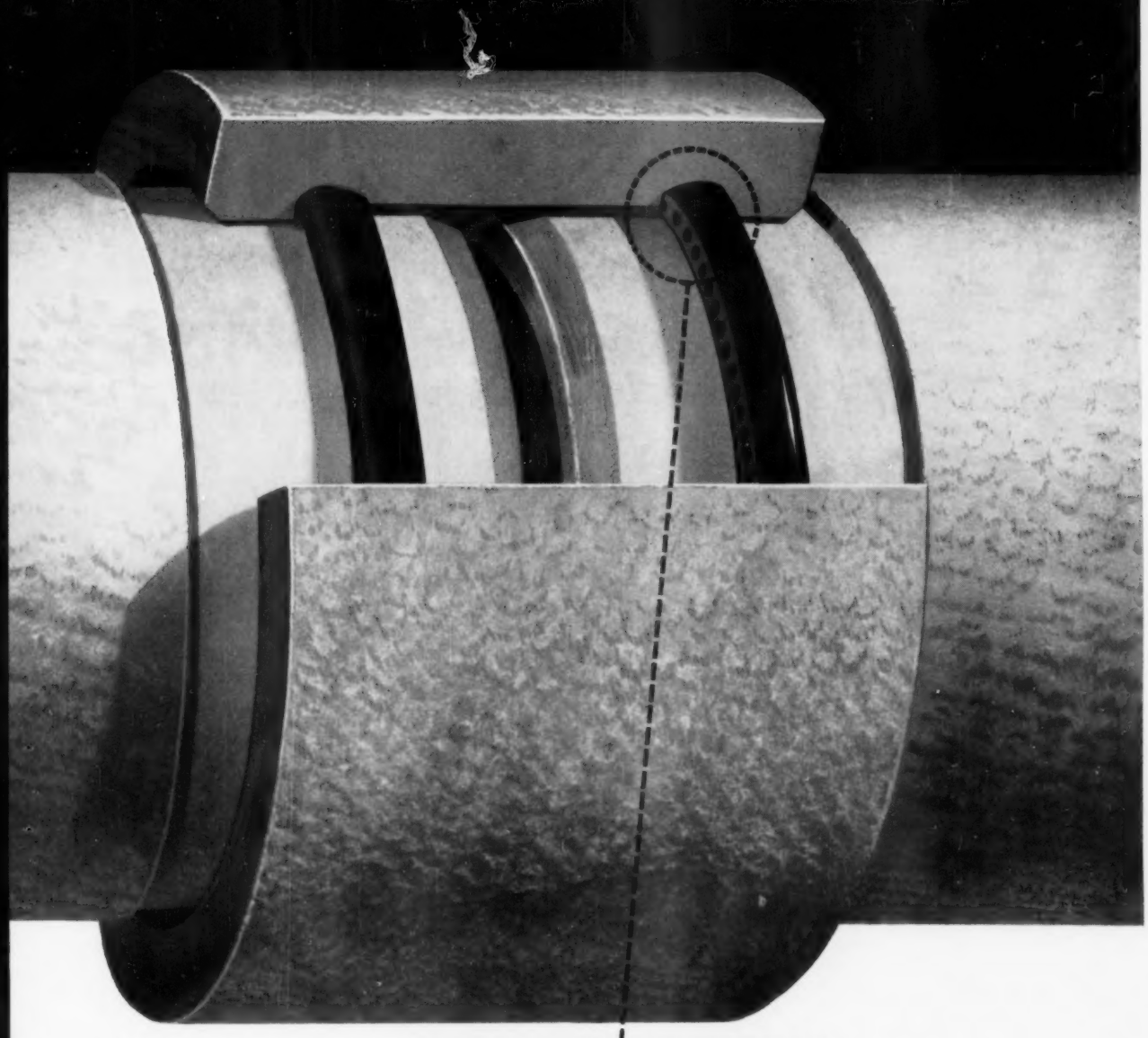
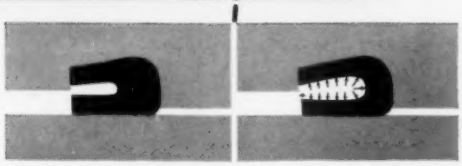


SELF-ENERGIZING SEALING RINGS

allow pipe to slide into coupling easily. Water pressure automatically expands the rings. The higher the internal water pressure, the tighter the seal.

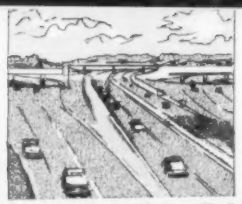


New self-energizing "Fluid-Tite" sealing rings have tapered surfaces, and compress, to permit pipe to slide in easily.

When main is filled, rings expand with application of internal water pressure, creating a tighter seal.

*@Patent applied for

Now's the time to mail this month's Readers' Service Card.



PUBLIC WORKS DIGESTS

THF HIGHWAY AND AIRPORT DIGEST

Designing Bituminous Paving Mixes in Ontario

The Ontario Dept. of Highways has for some years been developing a method of laboratory design for bituminous surface course mixes, using as a basis the Marshall method of design. As a result of their experience, they have concluded that: "While it would be desirable to have a rational design method, some empirical tests may provide advantages in speed and economy of testing. The Marshall design method provides a test that is rapid, economical, and adaptable to field use. The results of our work suggest that it is very dangerous to adopt an empirical method without first checking the validity of the procedures and criteria for the use to which it will be put.

"We have had reasonable success with the Marshall method, using revised procedures and criteria to suit our own conditions.

"The general knowledge of bituminous mix design is by no means complete. Many agencies have developed methods suitable for their own conditions, but not universally accepted. The need for continuing research is obvious."

"Experience with Design and Testing of Bituminous Paving Mixes in Ontario." By Merritt M. Davis, Research Engr., Ontario Dept. of Highways. *Roads and Engineering Construction*, December.

Regulations for Driveway Construction

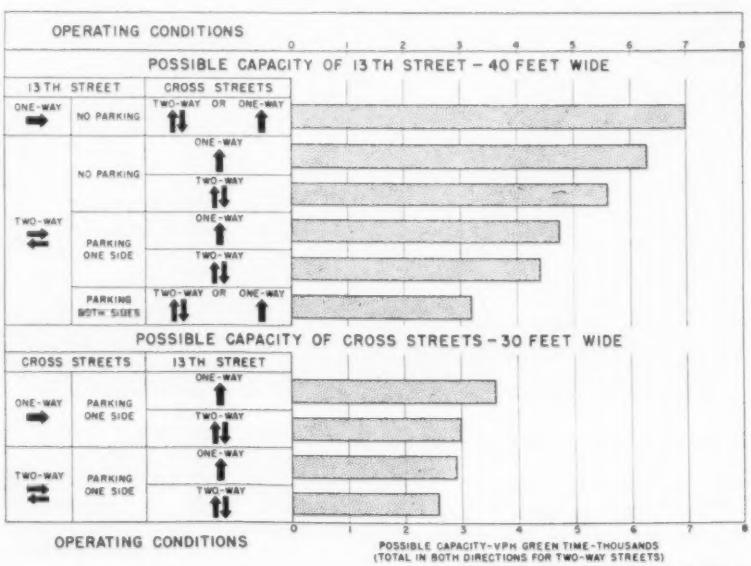
To keep highways safe and efficient, entrances and driveways, whether commercial or residential must be so designed as to afford safe entrance and exit for vehicles. This article summarizes the rather complicated requirements of three states—Ohio, North Carolina and California. In each state, driveways to properties facing a state highway can be constructed only after a permit has been obtained from the state highway department, and the construction must conform to explicit regulations as to location and design, which are given here in detail.

"Driveway Construction Regulations of State Highway Departments. PUBLIC WORKS, February.

Signal Control And Highway Capacities

The Bureau of Public Roads has made a study of the conditions under which traffic signals, two-way stop signs, and four-way stop signs provide most efficient operation of highway traffic. The studies were made at four intersections on 13th St., NW, Washington, D.C., a four-lane street which carries more than 3,200 vehicles per hour during the peak period, and is operated as a one-way street inbound during the morning peak and outbound during the evening peak. The possible capacity of the one-way through street, 40 feet in width, described in this article was found to be 7,000 vehicles during each hour of green signal time. With the light green during one-half of each signal cycle, it is thus possible to carry 3,500 vehicles during each clock hour. Since an ideal combination of conditions, some of which remain to be measured, is evidently necessary for the attainment of these high volumes, there is no assurance that such high capacities can be designed into a city street system. The traffic volumes given in the Highway Capacity Manual are usually attainable under average conditions, and the values reported therein are generally appropriate for design purposes.

All-way stop signs, the general term which includes four-way stop signs as well as the situation when one or more of the streets are one way, have been used more extensively in recent years. There has been considerable discussion by engineers as well as the driving public of the relative merits of all-way stop signs, the more usual stop signs on the cross streets only, and signal control. In this article capacities with signal control, with stop signs on the cross street, and with stop signs on all approaches are compared. From this comparison it ap-



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● **STREET capacity with signal control related to directional operation and parking.**

When a job needs TRACKS AND POWER...

CAT* track-type Tractors get the call!

Farm-to-market road being regraded and drained by Shirley Construction Co. for Polk County, Iowa. Cat Diesel D6 Tractor with No. 6S Bulldozer is one of nine Caterpillar units on job, moving 250,000 cu. yd. of earth.

"Iowa county roads are pretty much alike," says Guy Blunck, General Supt. for the Shirley Construction Co. "No big cuts or fills—just short runs with plenty of deep ditches to crawl in and out of. And many of the roadbeds are only 24 feet wide. It takes a machine that can make turns in a minimum of space. And it takes *tracks and power* to go into, and back out of, those steep ditches."

That's why Shirley Construction Company's fleet on a new Polk County road project is almost 100% Caterpillar. "I think it's the best equipment there is," Mr. Blunck says. "It's just cut out of better calico, that's all."

Take the Cat D6 track-type Tractor. Highly maneuverable, with 85 HP on tap for tough assignments, the D6 is also a long-lasting, economical investment. Maintenance costs are low: the D6's exclusive Caterpillar Oil Clutch, for instance, rarely requires adjustment. There's longer wear built into such details as the specially heat-treated track shoes, securely tightened to specially hardened links by "Hi-Electro" hardened bolts and tight-fitting nuts. This kind of extra care in manufacturing makes the D6 a harder working public servant for you.

And it's versatile, too. Equipped with a Cat-built Bulldozer, the D6 is handy at street leveling or widening, backfilling trenches, heavy grading, snow removal, sewer work—all sorts of city and county jobs.

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pears that stop signs on the cross streets only are practical at traffic volumes considerably below those at which the other two types of control are feasible. When both streets are two way, four-way stop signs appear to be practical at traffic volumes approaching those observed for signal control. With the through street one way, however, progressive signal control was found to provide substantially greater capacity than either of the two types of stop-sign control.

"Capacities of One-Way and Two-Way Streets With Signals and With Stop Signs." By Alexander French, Research Eng., BPR. *Public Roads*, February.

Kelly Ball for Measuring Concrete Consistency

The Kelly ball test is a simple field method for determining the consistency of plastic concrete. It is made by measuring the penetration of a 30-lb. metal "ball" into the surface of the concrete in place, which requires much less time and effort than the slump test. The data reported in this article show good correlation between the slump and Kelly ball test. Three or more Kelly ball tests can be made at a selected location in less time and with less effort than one slump test. This should encourage more frequent testing for controlling the uniformity of the concrete. The apparatus can be maintained in usable condition between tests by merely wiping with an oily rag. This test is practical for use with concrete having coarse aggregate exceeding 2 in. in size, which the slump test is not.

"Use of the Kelly Ball as a Device for Measuring Consistency of Concrete." By William E. Grieb and Robert A. Marr, Jr., Research Eng., BPR. *Public Roads*, February.

Making a Fill On 80 Feet of Mud

The Bayshore Freeway, San Francisco, crosses an arm of San Francisco Bay approximately two miles wide, with underlying mud nearly 80 ft. deep in places. Two methods of making the fill for the road were considered: displacing the mud with dry fill by end dumping, and predredging the mud. The former would be cheaper and plenty of fill material was readily available; but before definitely deciding to adopt this method, it was tried out on a section reaching 40 ft. depth; and again on a haul road to a point where the mud was 60 ft. deep. At first the fill was advanced on a front 400 ft. wide, which was reduced to 250 ft. as the work progressed on the first trial section; and in the haul road the front was made only 30 ft. The latter resulted in nearly 100 percent displacement of the soft mud. It was found that the amount of displacement was influenced by the shape of the advancing face, type of hauling equipment, rate of placing the fill, elevation at which it was carried, stoppages, type of fill material, strength and depth of the underlying mud, and tide action. On the basis of these tests, a contract has been let for placing the additional 1,200,000 cu. yd. needed to complete the fill, which is now underway.

"Open Water Fill." By Vincent O. Smith, Sr. Highway Eng., Calif. Hwy. Comm. *California Highways*, December.

Equipment for Marking Traffic Lines

During several years past the Equipment Dept. of the California Div. of Highways has developed a fast, economical highway marking machine which has been followed, to a large degree, by approximately

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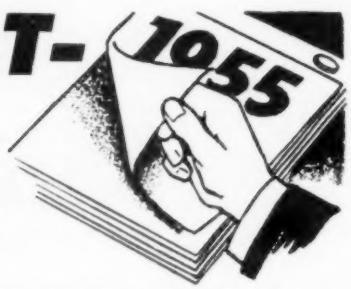

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Anything and everything goes into an M-B Packer — large cardboard boxes, wet garbage, wooden crates, drums, springy tires, powdery ashes, leaves, brush — there's no selective loading or pre-crushing. Those occasional items too large for the extra-wide side loading doors can be carried on the flat reinforced roof.

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30 other states. This machine not only paints the stripes but precleans the surface to be painted and applies reflector-type glass beads, all in one combined operation. It is made up of a 3-ton truck chassis with a special flat-rack body, which pushes a marking machine which is equipped with a motor-driven cleaning brush, paint gun, and bead dispensers. The truck carries an air compressor, air receiver, paint tanks with agitators, a solvent tank, and an engine generator. For winter operation the traffic line paint is passed through a hot-water heater, the water being supplied from the truck radiator. A rear platform facilitates placing traffic marker cones. An automatic chute is being designed to permit placing of the cones by a man standing in the bed of the truck. The accurate location of the stripe is controlled by the striping machine operator. The most effective results are obtained at an approximate 5 miles per hour speed. It is possible that the marking machine may be eliminated by using a long wheelbase vehicle with a front-wheel drive, and suspending the marking machine near the rear of the truck; or suspending it from the front end of the truck by cantilever support.

"Traffic Lines." By Earl E. Sorenson, Equip. Eng. *California Highways*, December.

Clay in Concrete Aggregates

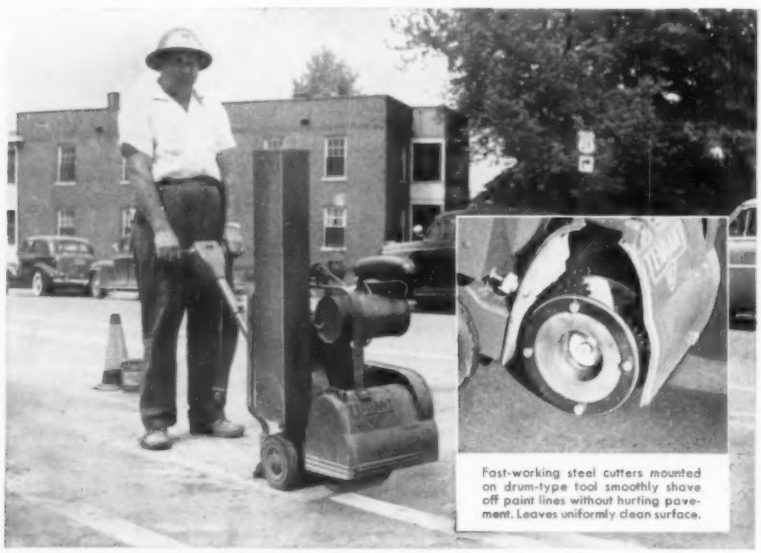
It has long been considered that clay coating particles of mineral aggregate was deleterious. Specifications generally place a limit on the amount of material that will pass a No. 200 sieve by wet sieving. This test does not evaluate either the quantity or activity of the clay, or distinguish between clay and inert dust. Moreover, concrete made with aggregate rejected by the sieve test has sometimes been found to be practically as strong as that made with the same aggregate after it has been scrubbed. What is known as the "sand equivalent test" has been developed in the laboratory of the Materials and Research Dept. of the California Div. of Highways. This is applied to sand passing a No. 4 sieve, and a sedimentation test is applied to coarse aggregate. An investigation by the department shows that these two tests furnish indexes of the quantity and activity of the clay in aggregates that could not be obtained by other test procedures. These tests appear to be the only rapid ones presently available that can be used to insure that aggregates are really clean. Tests show that the inclusion in the specifications of a minimum sand equivalent of 80 for fine aggregate and a maximum sedimentation value of 5 for coarse aggregate for portland cement concrete, while requiring more thorough processing than formerly, results in an improvement that is real in its effects on strength and more importantly on volume change of the resulting concrete.

"Findings of the Effect of Clay on the Quality of Concrete Aggregates." By Bailey Tremper and W. E. Haskell, Materials and Research Engineers. *California Highways*, December.

Economical Precast Bridges

Engineers of Harvey County, Kans., believe that the bridges they build on their primary highways, using prestressed precast concrete beams and costing approximately $115 per lin. ft., are the answer to their search for an easy-to-build, economical bridge where the beams are 40 ft. long or more. The author describes the method and equipment they use.

"Precast Design Answer to Search



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Machine has self-propelling action. Operator merely guides it over traffic lines. Cylindrical tool with scores of steel cutters revolves at 1450 rpm—smoothly shaves off paint in one operation. Covers path 4" wide; adjustable to cover path up to 7" wide.

- Works up to 5 times faster than other methods.
- Erases paint lines permanently; does not hurt surface.
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- Works during normal hours without tying up traffic.
- May be used on concrete or asphalt.
- Covers path 4" wide; adjustable up to 7" width.

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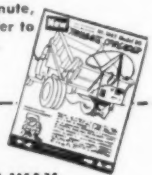
A uniform spread is assured in all spreading operations, at speeds varying from 1 to 36 m.p.h. and in widths from 4 to 60 ft. Material is also spread ahead of the rear wheels of the truck, assuring traction under all conditions.

No other spreader compares with the Model DD.

The Model DD clamps onto the tailgate of an ordinary truck dump body, attaches or detaches in one minute, allowing one spreader to serve several trucks.



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for Economical Bridge." By Paul D. Newcomer, County Eng. *Better Roads*, January.

Stabilizing Loose Sand With Muck

In rebuilding A-1-A, running south from Fernandina, Fla. to Daytona Beach, on a continuous sand dune, the old, narrow penetration surface was broken up and removed, and the loose sand was stabilized with muck taken from borrow pits on the inland side. The muck is basically marl, somewhat like blue clay, holds considerable vegetable matter and yields to pressure like putty. It was worked in by repeated scarifying while subjected to heavy traffic, which was kept at 10 mph behind flag trucks. On this base was laid a double penetration pavement.

"Muck Stabilizes a Loose Sand Base." By Guy Browning Arthur. PUBLIC WORKS, February.

Patching Low-Type Bituminous Pavements

How to blend new patches to the surrounding surface of a bituminous pavement so they are not conspicuous, and more important, how to obtain a smooth permanent riding surface, was a question submitted to and answered by a number of highway officials. One emphasizes the importance of making repairs as soon as possible after a break in the surface is noticed, to prevent its size increasing. Many highway departments use premixed material, either purchased from a commercial plant, or mixed by department forces in quantity and stock-piled. For large patches, some engineers prefer to use the mixed-in-place method of patching, using motor grader blades. Some departments compact the new patch with truck wheels, others prefer a small patching roller. Most departments are not particularly concerned with the appearance of the patch; however, the South Dakota Department seals the patch and covers it with sand or chips if there is a very noticeable difference in appearance. If a road surface requires a large number of patches, it is time to determine the cause of failure.

"Patching Low-Type Bituminous Mats." *Better Roads*, December.

Other Articles

"Six Feet of **Snow.**" Handling it in a city of 20,000 people, Kingston, N. Y. By Ernest A. Steuding, Supt. of Public Works. American City, January.

"**Photogrammetry** in Highway Location." By George Hess, Canadian Aero

Service, Ltd. Roads & Engineering Construction, December.

"**Results of WASHO Road Test.**" By W. N. Carey, Jr. Project Eng., Highway Research Board. Civil Engineering, January.

"Problems of Highway **Right-of-Way** and Control of Access." A consideration of fundamentals. By David R. Levin, Chief of Land Studies, BPR. Better Roads, December.

"No Waiting for Weighing with New **Electronic Scales**" in Minnesota. By Vince Bovitz, Dept. of Highways. Better Roads, December.

"New Home (**office building**) for Colorado Department" of Highways in Denver. Better Roads, December.

"**Road Management** Pays Off" in Contra Costa Co., Calif. By Victor W. Sauer, Road Comr. Public Works, February.

"An Improved **Sulfate Soundness Test** for Aggregates." Changes proposed in the WASHO test by the BPR. By Donald O. Woolf, Research Eng. Public Roads, February.

"Concrete **Pipe Jacked** Under a Freeway" in California; 2,000 ft. of 24 to 54-inch. Public Works, February.

"**Employer - Employee Relations**: Fringe-Benefits" in Walla Walla Co., Washington. By B. Loyal Smith, Co. Eng. Public Works, February.

"New Jersey Breaks Tradition in Design of **Highway Map.**" State map in booklet form instead of the usual large single sheet. By W. Carman Davis, Ex. Asst., State Hwy. Dept. Better Roads, January.

"**Electronic Signal System** Speeds Philadelphia Traffic." Public Works, February.

"How Did We Do in **1955.**" Review of highway construction during the year. By Duane L. Cronk. Roads and Streets, January.

"**High Gravel Production** in a Wet Pit." A contractor's devices to overcome flooding of a gravel pit, in Ohio. Roads and Streets, January.

• • •

Suit for Patent Infringement on Grit Removal

A suit has been filed against the city of Baytown, Texas, by Chicago Pump Co. The suit charges that the aerated grit removal system installed by the city infringes patent No. 2,532,457 which covers a method of and apparatus for removing grit and like sedimentary matter from sewage.

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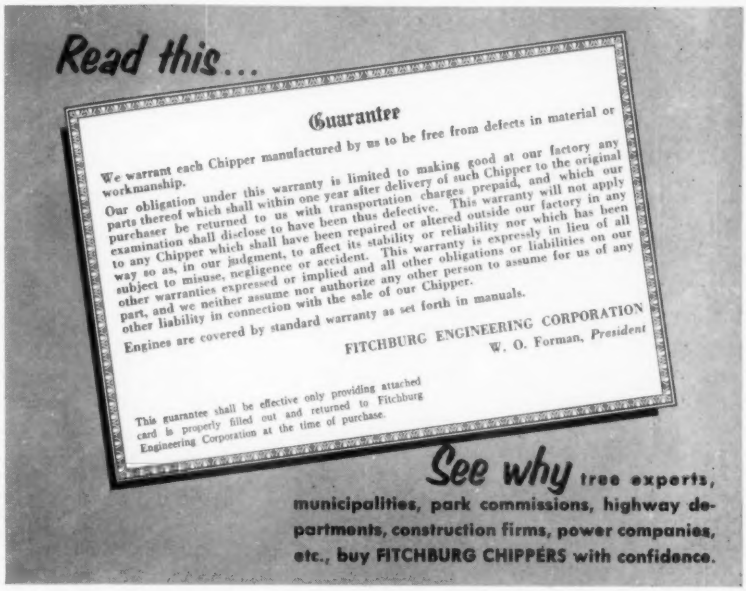
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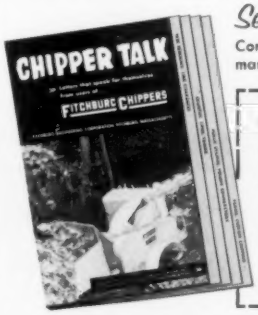
Many chipper owners do. But one word of caution. *Know what you are buying.* Ask for *full* specifications and be sure you purchase the proper machine for your operation. Be sure also you don't get bids on stripped-down machines with extra costs to come later for equipment necessary to get the machine into operation.

Bids on FITCHBURG CHIPPERS are made on complete machines (with extra set of blades) ready to operate, and rated by experts for your own brush disposal problems. Ask for a demonstration and compare. *Pay special attention to quietness of operation.* This is important when operating on residential streets. Your FITCHBURG CHIPPER will help you solve brush disposal problems with speed, efficiency, and relative quietness of operation.



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AUSTIN-WESTERN MODEL "40"—

FASTER DUMPING

Dumping to the rear is an important Austin-Western feature. The rear broom is raised, and the hopper gate moved forward and upward, by hydraulic power; depositing the load in a neat pile at the rear of the machine, as the operator moves the Sweeper slowly forward.

The operator is ready to resume sweeping after moving the machine sufficiently for the rear broom to clear the forward end of the pile . . . and all done in less than one minute, for the Model "40" stays in the sweeping lane; does not back up or maneuver around the pile.

DUAL OPERATION

One-way streets, separated pavements, island areas and congested traffic lanes present no problem when the Model "40" Motor Sweeper is equipped with two gutter brooms. Its 9-foot sweeping width proves particularly advantageous when sweeping large areas as in airports, parks, stadiums and parking areas, as well as around industrial plants.

Special driving and steering controls are not needed, and three-wheel, front-steer design gives the operator a perfect view of both gutter brooms as well as the entire street, whether using the brooms singly or together.

Important to remember, too, is the fact that the Model "40" Motor Sweeper can be purchased with a single gutter broom, and the second broom added later, as the need arises, at very little additional cost.

the world's BEST BUY in a motor sweeper !

The Sweeper Built to OUTPERFORM

ELEVEN OUTSTANDING FEATURES

1. No conveyor, no elevator . . . the 5-foot gear-driven rear broom sweeps directly into the hopper.
2. Bump-proof, oscillating gutter broom. Equipped with tilt and pressure adjustments.
3. Large hopper . . . operated by effortless hydraulic control. Includes built-in hopper flushing device.
4. 7-foot sweeping width using one gutter broom (either right hand or left hand).
5. 9-foot sweeping width using two gutter brooms (for unusually large areas or one way streets).
6. Load can be transported any desired distance.
7. Front steer, plus three wheel design for full maneuverability . . . front mounted motor.
8. Handles like a truck—simply—safely . . . full view in every direction from the driver's seat.
9. Positive drive to both rear wheels . . . power to spare for tough sweeping on steep grades.
10. Leaf broom attachment solves the leaf problem.
11. Dumps to the rear and resumes sweeping without backing or leaving path of travel.

BETTER VISIBILITY

On any street, there are many things the operator of a sweeper has to watch, and with the Austin-Western Model "40" Motor Sweeper he sees them all. Only with the Model "40" Sweeper does the operator have an unobstructed view of everything and everybody around him at all times. There are no "blind spots" for the man behind the wheel of a Model "40".

LOWER UPKEEP

The rear broom picks up the material on the street, and retains it until it passes over the Deflector Bar, which is adjusted to just touch the ends of the broom fibre. It's the "World's Shortest Conveyor," doing the work of a full-length conveyor at a fraction of the cost. All dirt, including bricks, bottles, cans and sticks, passes between the exclusive, patented Deflector Bar and the broom; then is "flicked" forcibly into the forward end of the hopper.

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U S Geological Survey Mapping Program

Mapping of United States areas requested by the Department of Defense has occupied nearly half the capacity of the U. S. Geological Survey during the past ten years, according to Gerald FitzGerald, Chief Topographic Engineer, in a paper before the recent ASCE Dallas meeting. Planned mapping for immediately foreseeable military purposes involves work in 48 States, Alaska and the Hawaiian Islands and totals nearly 1,000,000 square miles. Topographic mapping by the Geological Survey has increased tremendously during the past ten years. The average output before World War II was 100 or less maps a year. The total was 1,547 for the fiscal year 1955.

Mr. FitzGerald said that ten years ago about 25 percent of the United States was mapped adequately and it was estimated the completion of the job would cost $400,000,000. He added that at present the adequately mapped percentage is 37, with about 17 years and some $200,000,000 needed to finish the present program. He went on to say: "This cost estimate for the job remaining, when added to the funds available during the past 10 years, indicates the present estimated cost of doing the job proposed in 1946 is about $328,000,000. This new estimate, lower than the 1946 estimate by about 20 percent in spite of inflation, is principally a reflection of the more efficient procedures that have been brought about through our research activities."

• • •

Fresh Water from Salt in Peru

It is reported from London that a British firm has contracted to convert sea water into drinking water in the Lobitos oil field in Peru, located in a waterless desert. The first plant to be supplied will provide 270 tons of fresh water a day and the second will have an output of 500 tons a day. The firm is carrying out a similar contract in the East Indies. The method employed includes evaporation and distillation.

• • •

Chain Saw Use Saves City $39,000

Recommendations by Griffenhagen & Associates to the City of Milwaukee, Bureau of Forestry, for the use of power chain saws for tree removal operations, has resulted in estimated annual savings of $39,000. As yet, such saws have not been utilized in pruning operations.

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PUBLIC WORKS DIGESTS

THE SEWERAGE AND REFUSE DIGEST

Decomposition in a Sanitary Landfill

The sewage treatment plant of the East Bay Municipal Utility District treats the sanitary sewage and industrial wastes from six California cities. Since 1951 it has used cut-and-cover sanitary landfill for disposing of bar screenings, grit, grass clippings, rubbish, etc. During August, September and October, fruit and vegetable canning waste solids are present in large amounts in the bar screenings. To determine the decomposition efficiency of the fill, samples were taken at various depths and tested in the laboratory. These tests indicated that the organic materials in the fill are generally almost 98 percent decomposed in one year and more than 99 percent in two years; except that where the material included cannery wastes, only 50 percent decomposition occurs in one year and about 96 percent in two years.

"Decomposition Efficiency in Sanitary Landfills." By Gerson Chanin, Chf. San. Chemist. PUBLIC WORKS, February.

Automatic Control of Plant

Sioux Falls, S. D. operates a plant which treats sewage; 35 percent of the volume is industrial waste, mostly from meat packing. These wastes are preaerated prior to primary settling. Most of the industrial waste reaches the plant during 8 hours of the day, and part of it is stored and released later so that it is possible to obtain a continuous rate of flow to the plant, and the installation of smaller units throughout the rest of the plant. The uniform rate of flow is obtained by use of a rate-of-flow controller, pneumatically operated. The bar screens are automatically cleaned by a Honeywell pneumatic controller. The thin activated sludge is concentrated in DeLaval centrifuges, the rate of flow to which is very closely controlled by Honeywell equipment. The flow to the sludge thickeners is similarly controlled. The rate of flow of gas to the gas compressor is so controlled that, whatever the rate of gas production, the compressor maintains 6 in. of water pressure on the digester, other controls sending the surplus gas to, or withdrawing it from, storage. "The application of instruments has proven to be a real improvement in plant control."

"Automation Controls Handling of Sewage and Abattoir Wastes." By Leland Bradney, City Chemist, and R. E. Bragstad, City Engineer. *Wastes Engineering*, January.

Sewage Sludge On Ash Dumps

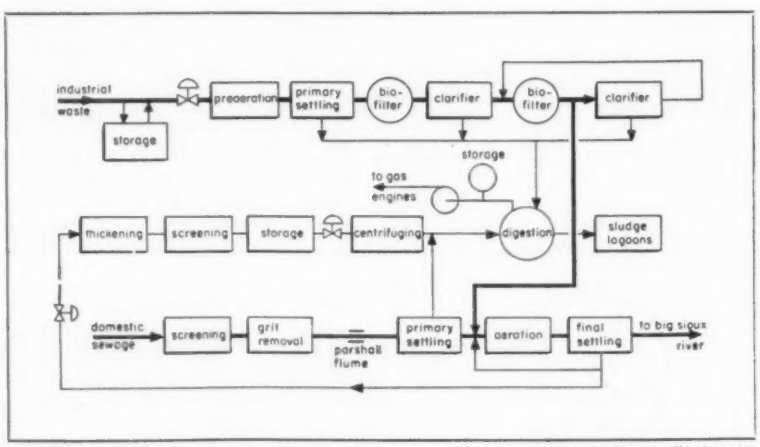
Tests of the desirability of disposing of sludge from sewage on ash dumps were conducted in England, on a dump 40-50 ft. deep of ashes from a power station. Several methods of applying the sludge, usually in a 3-in. or 12-in. layer covered with 3 in. of soil, were used. Some of the sludge was from purely domestic sewage; other tests were made with sludge that contained much waste from metallic industries. These were sown with rye and clover which did not become established on the ash, or on the sludge containing metallic wastes, unless given a covering of soil. On the purely domestic sludge, both grasses grew abundantly, especially rye; most abundantly on the deeper sludge, or sludge covered with 3 in. of soil.

"Sludge for Agriculture." *The Surveyor*, Dec. 17.

Particle Size Of Ground Garbage

In view of the increasing use of household garbage grinders, the establishment of a uniform particle-size distribution code and a reproducible procedure for determining particle size are desirable. The authors in this article present and propose the adoption of a code and describe a procedure. The proposed code includes a standard procedure for determining particle size, using a synthetic garbage of fixed composition; and a range of percent passing each of 8 sizes of sieve, from ½ in. to No. 60. The maximum size is limited to ½ in. so that no particles will settle out in the sewer; and the minimum size so as to limit the amount that will pass through the sedimentation tanks to the secondary treatment processes.

"Particle-Size Distribution of Ground Garbage." By E. Robert Baumann, Darrell A. Dorman and



Courtesy Wastes Engineering

● **FLOW diagram, combined treatment plant for packinghouse wastes and sewage.**

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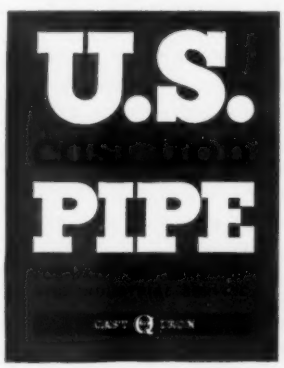

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Marvin T. Skodje, Eng. Exp. Sta., Iowa State College. *Sewage and Industrial Wastes*, November.

Testing for Total Pollution Load

The conventional BOD test cannot be relied upon to give a true estimate of the total pollution load of a waste. To obtain the best estimate, it is also desirable to use the Van Slyke combustion test for total carbon; one or more COD (chemical oxygen demand) determinations; ammonia nitrogen; and nitrosomonas count.

"The BOD Test and Total Load." By A. M. Buswell, Chief, Illinois State Water Survey. *Sewage and Industrial Wastes*, November.

Dome Diffusers For Activated Sludge

At the treatment plant of Stoke-on-Trent, England, there are two sets of diffused air aeration tanks, one of which is fitted with 8″ x 36″ flat plate diffusers; the other with 4-in. dome diffusers at 6-in. centers. The latter are reported to be as efficient as the flat plate type when the air volume per dome does not exceed the 0.4 cfm. The author says that 7-in. domes should be used where the volume of air per dome may exceed 0.3 cfm, and this size is being used on all new plants, since the tendency is to increase the volume of air and reduce the capacity of tanks, because of decreasing cost of power. As compared with the original 12-in. square type, the 7-in. dome diffuser has a longer life, more even diffusion, and considerably less maintenance cost.

"Improved Air Diffusers for Activated Sludge Process." By E. P. Coombs, Activated Sludge L'td. *Municipal Engineering*, Dec. 9.

Control of Flies On Filter Beds

Studies conducted by the Birmingham (England) Tame and Rea District Drainage Board have provided information which enables them to control filter flies by use of chemicals. The cheapest method is to apply gamma benzene hexachloride in the form of a water dispersible powder containing 6.5 percent of the active constituent at the rate of 20 lb. per acre of filter. This does not affect the filter efficiency, since scouring organisms other than insect larvae increase when the larval population diminishes.

"Demand on Sewage Treatment Services Almost Overwhelming." Drainage Board's report for 1951-55." *The Surveyor*, Dec. 17.

Principles of Activated Sludge

The authors explain at some length the principles relating to the control of the activated sludge process, as learned during the operation of eight biological treatment plants, and of modifications of the process and of the structures to secure increased efficiency, decrease cost, or provide for special characteristics or conditions. "Sludge age," "density index," step aeration, and activated aeration are defined, described and discussed at length. The *step aeration* process, they say, affords full activated sludge treatment, using only one-half the conventionally required aerator volume. *Modified aeration*, as compared with step aeration, requires about two-thirds of the total tank volume; lower sludge volume reduces sludge disposal costs; lower air ratios reduce power costs. It produces higher digester gas yield; and reduces the area of the treatment plant site. However, there is a sacrifice of effluent quality. *Activated aeration* is capable of providing an effluent of intermediate quality; of savings in air compression power costs; creates

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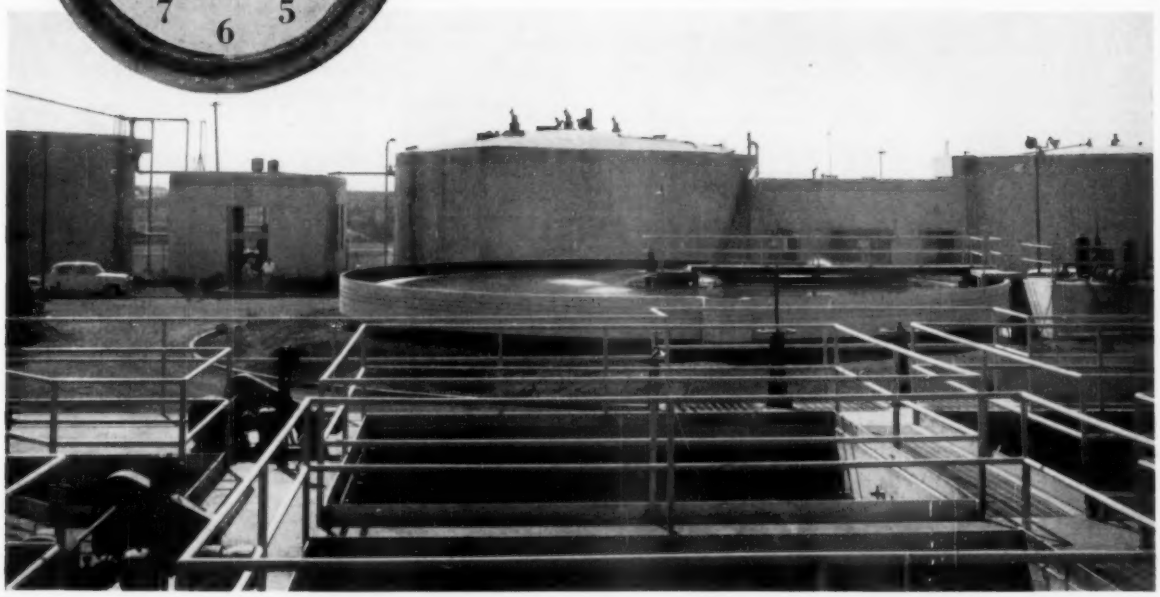

The installation of WEMCO Pumps at the sewage treatment plant in San Leandro, California, has completely eliminated down time on sludge transfer service. Previous down time losses amounted to 4 to 6 hours daily. These WEMCO Torque Flow Solids Pumps replaced plunger type pumps that had been having several stoppages per day.

San Leandro's sewage treatment plant has a special problem created by cannery wastes. During the last canning season, the WEMCO Pumps proved themselves by handling the increased sludge load without once clogging.

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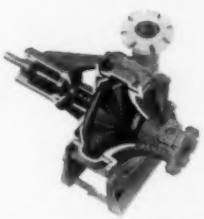

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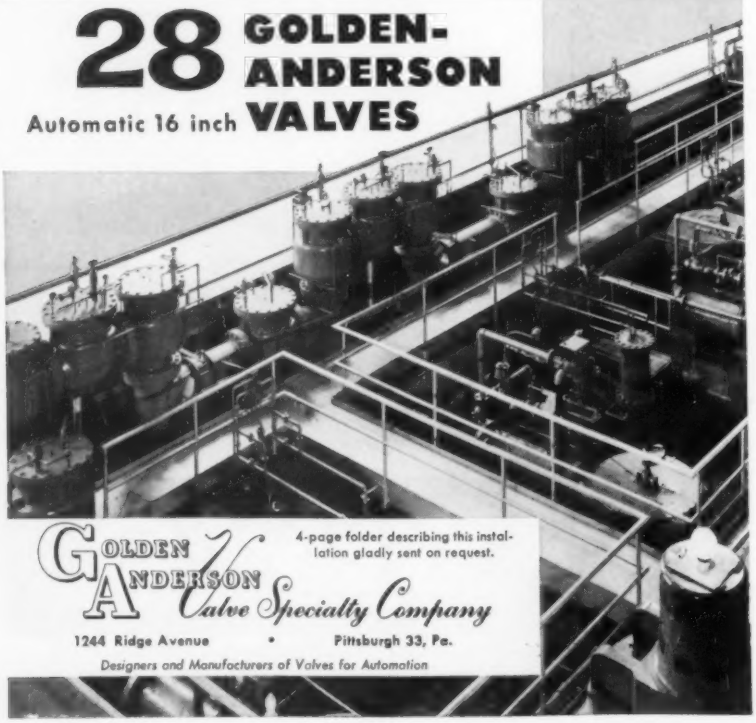

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less sludge volume; and should afford complete flexibility of operation between the range of full activated sludge and straight sewage aeration.

"Principles of Activated Sludge Operation." By Wilbur N. Torpey, and A. H. Chasick, Bureau of Sewage Disposal Operation, New York City. *Sewage and Industrial Wastes*, November.

Load Bearing Of Refuse Tips

To learn whether a sanitary refuse dump of domestic refuse covered with ashes could support medium weight aircraft, the city engineer of Liverpool, England drove over such a dump two vehicles with 12 x 20 in. tires inflated to 70 lb. per sq. in., with a load of 12,000 lb. on each of the eight tires, the two being kept as close together as possible. On the access road, consisting of two 4 ft. 6 in. layers of refuse with 6 in. of clinker on top, which had been used by refuse trucks for 14 months, there was no appreciable deflection. On a part of the dump 42 days old, on a 4-ft. 6-in. lift covered with 4 in. of ashes, the permanent depression caused by the tires was 1 to 2 in. deep. At another point 6 months old, the deflection was 1.2 in. in the center of the contact area and 0.2 in. at a point vertically below the outside edge of the tire.

"Load-Bearing Characteristics of Refuse Tips." *The Surveyor*, Jan. 7.

Other Articles

Test of a **Digester Additive.** "Digester Stretchers" at New Milford, N. J. American City, January.

"The **Jumping Turbidities** Don't Worry Us Any More," at Mount Carmel, Ill., since aodpting sludge-blanket type of treatment. By Elmo Conrady, Supt. of Water & Sewage. American City, January.

"Use of **Air Diffusers** in the Activated Sludge Process," including dome diffusers, at Stoke-on-Trent, England. By E. P. Coombs. The Surveyor, Dec. 17.

"**Disinfection** in Military Sewage Treatment Plants." By Harold A. Thomas, Jr., Assoc. Prof. of San. Eng., Harvard Univ. Sewage and Industrial Wastes, November.

"**Operational Responsibility** of the Sewage Treatment Plant Designer." By Kenneth W. Brown and David H. Caldwell. Sewage and Industrial Wastes, November.

"Fungi From **Trickling Filters.**" Six species found. By Albert E. Feldman, Biologist, Lawrence Exp. Sta. Sewage and Industrial Wastes, November.

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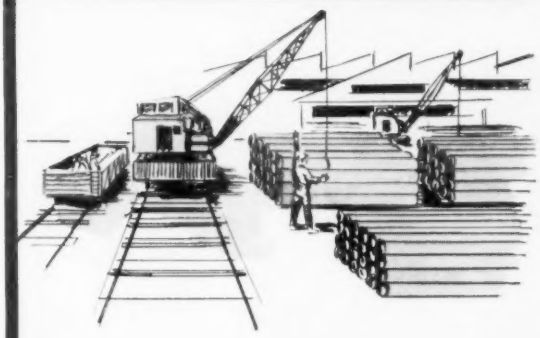

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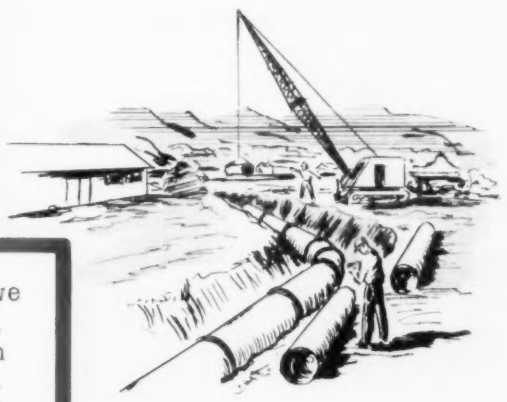

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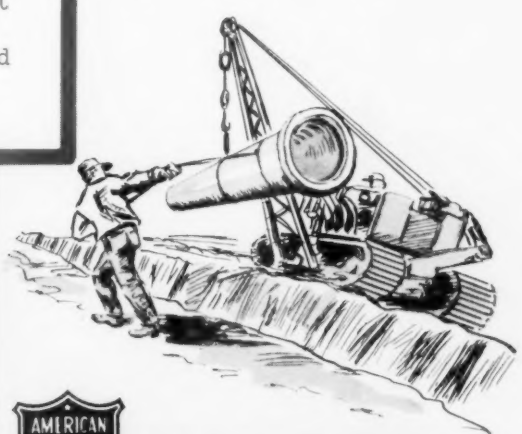

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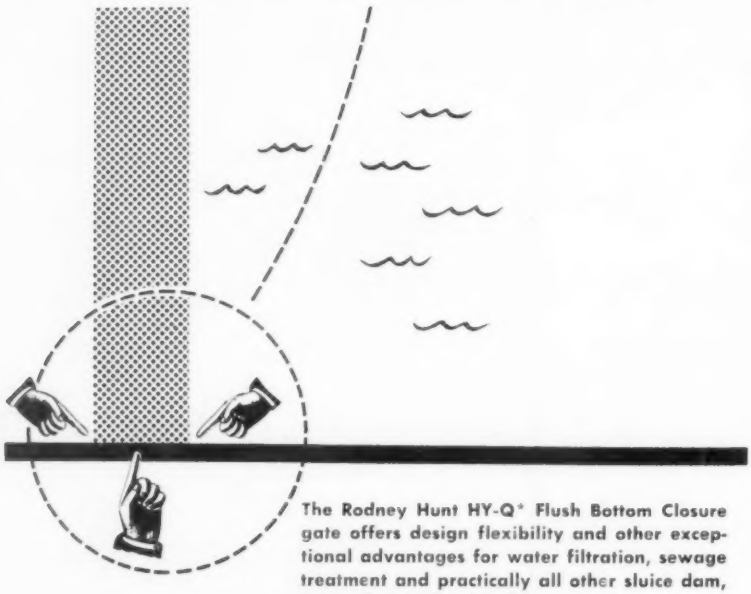

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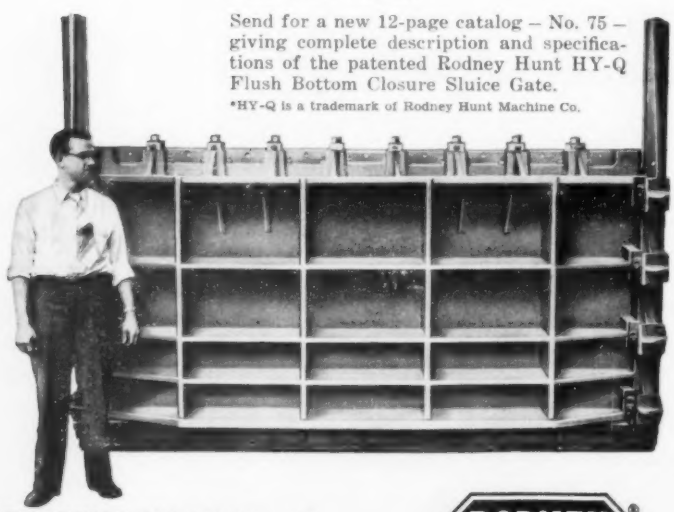

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Effect of Sewage-Borne Phosphorus on **Algae**. By John J. Curry, Chief Eng., Connecticut State Water Comm.; and S. L. Wilson, Biologist, Conn. Agricultural Exp. Sta. Sewage and Industrial Wastes, November.

"Relation of Phosphorus Content to **Algae Blooms.**" By Richard J. Benoit, Asst. Curator of Limnology, Academy of Natural Sciences. Sewage and Industrial Wastes, November.

"Philosophy of **Water Pollution Control** in California." By A. M. Rawn and Vinton W. Bacon, Calif. State Water Pollution Control Bd. Sewage and Industrial Wastes, November.

"Installing **Sewer Saddles.**" Detail description of procedure. By John A. McCollum, Foreman, Maint. Div., Los Angeles, Calif. Sewage and Industrial Wastes, November.

"Design of **Storm Sewers.**" By John G. Hendrickson and Thomas K. Breitfuss, Am. Concrete Pipe Ass'n. Public Works, February.

"The **Biology of Rivers** in Relation to Pollution." An extensive discussion, with special reference to conditions in a number of English streams. By F. T. K. Pentelow, Chief, Salmon & Fresh Water Fisheries. The Surveyor, Jan. 7.

"Percolating Filters As a Means of **Treating Gas Liquors.**" Experiments in England. The Surveyor, Jan. 7.

"Economical **Refinery Waste** Disposal" by use of dissolved air flotation. By Charles E. Fiske, Leonard Refineries, Inc. Sewage and Industrial Wastes, November.

• • •

Treating Wool Processing Wastes

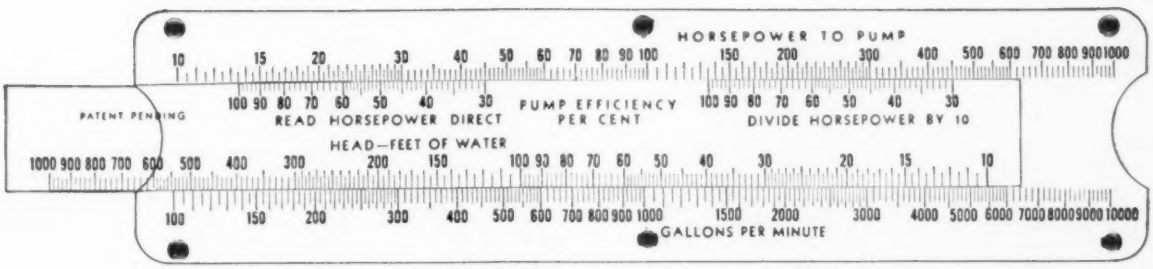
PROBLEMS of the wool processing industry in regard to waste disposal are discussed in Public Health Service Publication No. 438, which was prepared by the Stream Pollution Abatement Committee of the American Association of Textile chemists and colorists. Principal wastes are those from wool scouring, acid dyeing, carbonizing and piece or yarn washing. These, which are mixed in varying proportions from mill to mill, may have the following characteristics:

Wool Scouring: The waste amounts to 8,000 gals. per 1,000 pounds of clean wool: BOD ranges from 6,000 to 10,000 ppm; the pH is about 10.2; the color is brown and the odor foul.

Acid Dyeing: Amount of waste is about 3,000 gals. per 1,000 pounds of clean wool: BOD may range from 400 to 4,000 ppm; pH is about 4.0; color is variable, light to strong; and there is a slightly acid odor.

Carbonizing: Waste volume is 500

Reserved for you—Mr. Engineer...



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Now's the time to mail this month's Readers' Service Card.

gals. per 1,000 pounds of clean wool; BOD is low, 20 to 50 ppm; the pH is as low as 1.0; there is no color; the odor is acrid.

Piece or Yarn Washing: This procedure produces 5,000 gals. of waste per 1,000 pounds of clean wool, with BOD of 250 to 350 ppm; pH is 9.5; color is light brown; and the waste has a soapy odor.

Four ways of handling the waste problem are listed: Waste Saving is possible by careful control of the manufacturing process. By-product recovery is possible and should also always be investigated. Treatment with municipal sewage may be possible where the local plant is adequate, payment being made on one of several bases. Residual treatment provided by the plant is the fourth possible step, generally to be followed after other possibilities have been exhausted.

Combined Treatment

Factors to be investigated when use of a local municipal sewer system and treatment plant is contemplated include: (1) Relation of mill waste volume to the volume of sewage. Few reliable data are available to indicate what the proportion may be. Rudolf reported that 10 percent by volume of wool scouring waste did not adversely affect digestion processes, but 20 percent retarded digestion. However, there appears to be bacterial adaptation to the addition of such wastes, but the loading should probably not exceed the 10 to 20 percent range. In any event, the rate of feeding the industrial waste into the sewer system should be controlled to maintain a relatively constant rate.

(2) Effect of wastes on sewer or joint material should be investigated to assure that the composition of the wastes at any time will not damage the sewer system.

(3) The overload effect caused by the addition of the wool processing wastes must be investigated. This additional loading may require more digester or filter capacity; or it may effect the quality of the effluent from the plant, especially if strong slugs of waste reach the plant. Pre-treatment of the wastes may be necessary in order to insure a uniform waste of a strength that can be handled by the plant.

(4) On the basis of the investigations, a basis of cost can be established. This may cover all or a portion of needed new facilities; or may cover only increased operating costs, including amortization.

Treating the Wastes

Chemicals have long been used for treating wastes of this type. In general, it is not costly to clarify the wastes by coagulation and sedimentation, and a relatively clear effluent results; however, this is effluent still high in BOD and biological treatment is required if the waste is to be reduced in strength to a level that will normally permit discharge into a stream. Writing in the Sewage Works Journal in 1939, R. S. Weston outlined a program for systematic treatment, as follows: (a) Equalization of flow; (b) wool-grease recovery; (c) chemical precipitation; (d) drying the resulting sludge; and (e) biological treatment of the clear liquor resulting from the chemical precipitation process. Eldridge accomplished 72 per cent removal of BOD by using one pound of lime and three pounds of ferric chloride per thousand gallons of waste: suspended solids removal was 83 percent. Acid cracking, calcium hypochlorite and calcium chloride with carbon dioxide have been used, as has chlorination. Zach reported 70 percent removal of BOD from dye waste by lime and ferrous sulfate; lagooning still further reduced the BOD. Trickling filters have been used successfully for the final treatment.

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15 Ways to Get Better Construction and Lower Costs

EVERY CITY OFFICIAL is concerned with the job of getting the kind of public construction that will be a credit and a prideful addition to the community, and at the same time doing it as economically as possible—using the city's money to the very best advantage. Here are suggestions that can help to better construction at lower costs.

1. Exercise care in the selection of an engineer. There is no substitute for engineering judgment and experience. One-half of one per cent saved on engineering fees may add as much as 10 to 25 percent to the over-all price of the job. Don't forget that a job well designed is only half done—an incompetent engineer-inspector on the job can slow down the work and cost money. The inspector should be the equal of the construction superintendent.

2. Deal only with reputable contractors and surety companies. The lowest bidder may not be a responsible bidder and inexperienced or shyster contractors can cause a lot of trouble. A careful determination of the qualifications of contractors is strongly recommended to you. Don't take chances on surety companies! The United States Treasury Department issues a list of bonding companies or surety companies who are recognized by the United States Government for federal work. In addition, they will give you the limit on bonding capacity recognized for each company.

3. Be sure that construction plans are properly detailed and specifications are clearly worded so that the contractor will not have to guess at what is wanted or will be required and accordingly protect his bid, or have to guess at the intent of what is indicated but not actually shown. Avoid, as far as possible, the use of the phrases, "to the satisfaction of the engineer," "by order of the engineer," or "by direction of the engineer," If the engineer does not know ahead of time what he wants and is not willing to put it in the specifications and/or show it on the plans, the chances are that he won't know before the job is constructed, and there will be no way of determining what he will require during the construction period. When these things are left undetermined, there is nothing for the contractor to do but protect himself from requirements which are not included in the bid but which must be done to get the job accepted. This leads to prices higher than would be normal for a good job.

4. Do not specify materials or equipment which are not standard manufacture, unless some specific condition requires it, and then be sure about the condition. It is regrettable that some plant equipment manufacturers encourage their salesmen or agents to provide engineering assistance and/or plans and specifications for plants in order to get their equipment specified and more or less close the job to competition. When specifications are closed in such a manner the owner can pay excessive prices. A reputable engineer does not permit this, but where engineers are willing to cut fees on the job and cannot provide the type of engineering services required to make complete and exhaustive studies on all type of equipment for the job, selecting the best on a joint competitive and operative basis, then he must rely on the word of some equipment manufacturer because he is not in a position to formulate his own

Typical trench depth on $1,000,000 sewer excavation job by Geo. Sheaf & Company. Le Roi air power and Le Roi-Cleveland air tools were used to drill through rock.

Le Roi-Cleveland PL30 Drill Rigs, hung from crane boom, cut production time in half on the rock drilling project by Geo. Sheaf & Company near Tiffin, Ohio. Le Roi 600-cfm portable air compressors, and a self-propelled, 125-cfm Le Roi Tractair provided air power.

Rock-Drill Rig on Sewer Job Speeds Production 50%

Contractor uses Le Roi-Cleveland Air Tools to shoot and pull rock, often 18 feet deep, with one drilling.

The right air tools made quite a difference on a $1,000,000 sewer excavation near Tiffin, Ohio. Joseph Parker, General Superintendent of Geo. Sheaf & Company, Columbus, Ohio, states, "In nearly seven months of service in hard limestone, our Le Roi compressors and Le Roi-Cleveland Rock Drills had no down time, while in continuous operation 8 to 16 hours per day. They have performed to our utmost satisfaction. By using Le Roi-Cleveland PL30 Drill Rigs, we lowered our drilling costs and speeded production by 50 per cent."

Flexibility of special drill rig was a major factor in job speed-up. The Le Roi-Cleveland PL30 Drill Rigs provided unusual flexibility and ease of operation. This specially-designed rig, developed for rock work on pipeline projects, allowed the contractor to obtain proper drilling patterns for safe blasting in residential areas. Thus he cut construction time in half because he could shoot and pull the rock with only one drilling.

The Contractor standardized on Le Roi-Cleveland Air Tools using two PL30 Drill Rigs, two Model 52 Breakers, and two H10B Sinker Drills, plus hose, drill steel, and rock drill bits.

Le Roi air power helped speed up this project. Two Le Roi 600-cfm portable air compressors, and one self-propelled Le Roi Tractair (a combination 42-hp. wheel tractor and 125-cfm air compressor) were used.

This combination of Le Roi air power and Le Roi-Cleveland air tools gave the contractor exceptional drilling economies, including manpower savings, less upkeep, and more footage per shift.

Le Roi Division of Westinghouse Air Brake Co., Milwaukee 1, Wisconsin, manufactures portable and stationary air compressors, heavy-duty industrial engines, the Tractair and air tools. Write today for information about any of these products.

RD-78

conclusions on a basis of sound engineering determinations for the kind of equipment most nearly to meet the needs of the job.

5. Accomplish your construction through publicly advertised bidding and avoid the waste and inefficiency that can follow day labor methods where politics takes a hand in the job. When jobs are publicly advertised for a sufficient length of time, and reputable contractors have an opportunity to analyze the job and bid on it, the owner gets bids based on the best construction equipment available for the particular job, and has the advantage of obtaining the best procedures and methods known to all bidders. The owner thereby stands to gain the most construction for the taxpayer's money. Where the owner tries to "save the contractor's profit", buys equipment which may or may not fit the job and hires labor which may or may not be skilled and trained for a particular task, the job can foul up in many different ways.

6. Provide for arbitration of disputes between the engineer and the contractor, for in the final analysis the engineer is only the agent for the owner, who in turn is only one party to the contract. The engineer is not, as some of them would have you believe, the judge, jury, prosecutor, and hangman all rolled into one. High-handed tactics on the part of either the engineer or contractor will eventually cause trouble and will be reflected in job costs.

7. Furnish materials when and as required if the job is one on which the city is the material purchaser. If the contractor has no assurance of his delivery schedule and no control over the supplier, he stands to lose because of slow deliveries or is forced to resort to the courts for fair treatment and compensation for delays if arbitration is not provided for in the contract. Trying to save money by direct purchase of equipment and materials usually proves to be false economy and is not recommended. If engineers know how to write specifications to get what is needed on the job, there is no difficulty involved in letting the contractor buy the equipment, with the approval of the engineer.

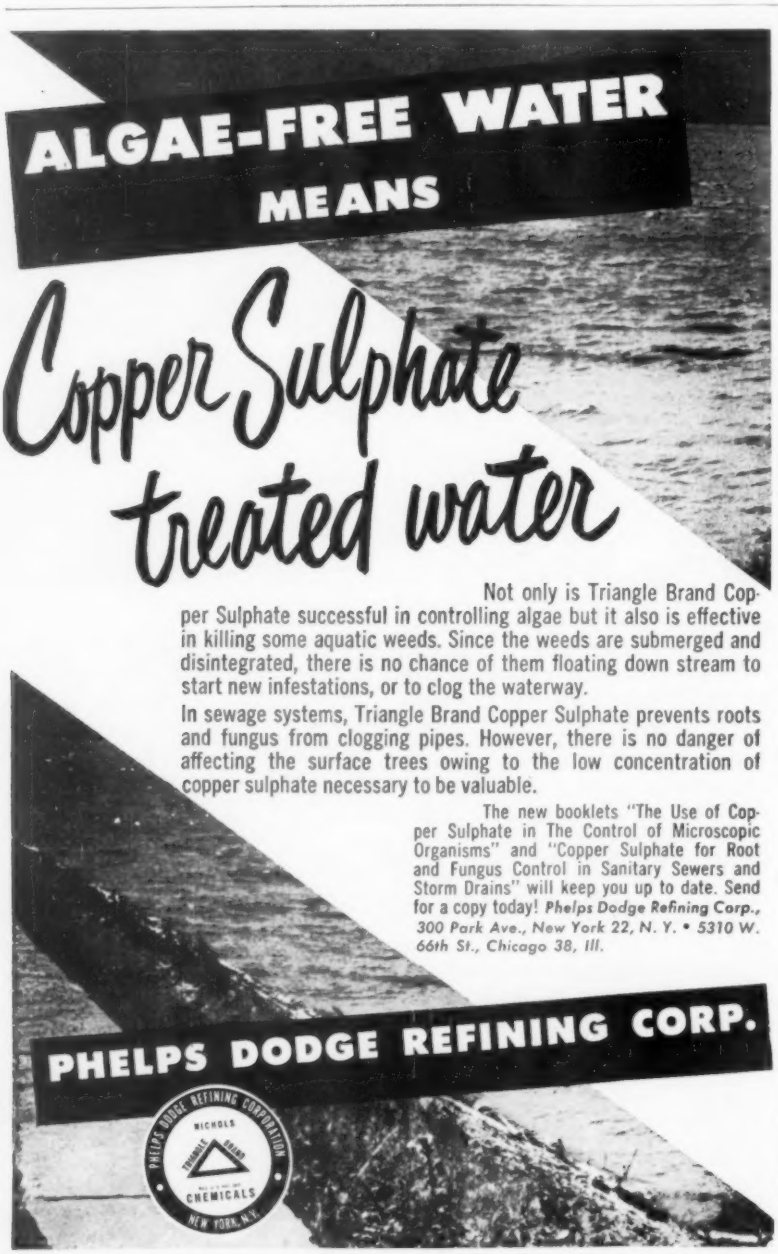
8. Avoid making the contractor the goat for omissions and second thought necessities. Whatever the job requires should be shown on plans or set up in the specifications, and if left out it shoud be paid for as an extra.

9. Specify results to be obtained by the contractor but don't restrict him as to how he obtains those results. New methods and new techniques are his stock in trade, and unless he is allowed to use these new methods he must obtain the price necessary to do it the less modern way.

10. Guard against setting up labor wage rates that are not realistic for the area. The state law requires that surveys be made to ascertain the prevailing wage rate but in some areas union scale building rates have actually been advertised as minimum rates to be paid by the contractor for the construction of water and sewage plants, water and sewer lines, pavements, airport aprons and runways, etc. When making wage rate surveys consider only work of a similar nature.

11. Put subsurface data and information on the plans—even if it is not guaranteed. If a contractor fieldchecks a couple of borings and finds them on the money, he will not be looking for a booby trap on every sheet of the plans.

12. Pick bid dates that do not conflict with other bid takings of similar work in the area, and allow adequate time for sound bidding. Bids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cannot be worked up without an appreciable amount of cost and that cost is borne by the contractor temporarily, but by the industry in the final analysis. Bidding should be made as convenient and economical as is practicable to do so. Where jobs are not urgent, hazardous projects should be done when the weather is likely to interfere the least. Deep open cut sewer work will naturally cost more in the winter than in the summer and river crossings during the rainy season are no lead pipe cinch. Allow enough time to complete the job and thereby avoid overtime payments to labor. Time is not always the essence of all jobs—even if it does usually say so in the contract documents.

13. Avoid hanging gingerbread on designs. Tricky new ideas are a temptation to some designers—just to see how it will work out—but they can be a headache and a pain in the neck to the operator who has to live with them after they have taken form in concrete and steel. Conservative and time-proven designs are normally the most economical. Be wary of new processes until they are backed up by sound operating data.

14. Dare to consult with a contractor or two during the development of the design. They may be able to offer suggestions that will cut the cost of the job and still get a good job. After all, the contractor is the man who will have to build the job, and pre-bidding conferences may be worthwhile. A lot of the contractors of today were engineers of yesterday and they are quite often in a position to see the problem from both sides of the drawing board. In these conferences check for their ideas as to cost.

15. Be sure you have enough money in your bond issue. A lot of estimates for bond issues are guesses on the part of some engineers, and where there is not enough money provided to do a complete job, the situation will never be pleasant and nobody wins under those conditions—especially the taxpayer. Do him a favor—a big favor—by remembering that he has an interest in the job, too. Try to protect his interest. He will appreciate it if you will. It is the contractor's bid rather than the engineering estimate that controls the cost of the job.

This article appeared in *Plans and Specs* published by Municipal Contractors Association of Dallas, Texas.

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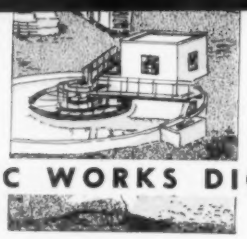


PUBLIC WORKS DIGESTS

THE INDUSTRIAL WASTE DIGEST

Treating Chromic Acid Wastes by Ion Exchange

At the Evendale, Ohio, plant of the General Electric Co. the principal waste problem is the treatment of chromic acid waste from the anodizing of aluminum parts, which has a concentration of 7 oz. of chromic acid per gallon. Two methods of treatment have been employed — one treating with ferrous sulfate, sodium metasulfite, or sulfur dioxide; the other to pass the waste through a cation exchanger, the resin in which is regenerated by a 10 percent solution of 66° sulfuric acid. This removes the aluminum, which can be recovered. The latter method is the more feasible; the operating costs total $5,550 per year. The cost of the chemical process is $27,862.

"Treatment of Anodizing Wastes by Ion Exchange." By Lacern M. Corcoran, Water & Waste Engr., G. E. Co. *Sewage and Industrial Wastes*, November.

Research in Industrial Wastes

Industrial wastes research of considerable magnitude is now being carried out in the United States. At least 428 projects are currently under way with a total annual cost in excess of $3,000,000. Some of the research is being sponsored or carried out by trade organizations or associations made up of representatives of the individual plants within a generic industry, such as the Iron and Steel Institute, the National Council for Stream Improvement (pulp and paper board), and American Petroleum Institute. There are still many types of industrial wastes requiring research. Research is also necessary in a number of related fields, such as instrumentation of the analyzing and recording types for monitoring the condition of effluents; to proportion the feed of treatment chemicals to the impurity requiring treatment; and modification of equipment used in sewage treatment.

"Is Industrial Wastes Research Dragging Its Feet?" By Kenneth S. Watson, Gen. Electric Co. *Wastes Engineering*, January.

Recovering Zinc Plating Wastes by Double Evaporation

Recovery of zinc plating solution as distilled water and plating solution is made possible by a method used by Channel Master Corp. of Ellenville, N. Y., makers of television antennas. The equipment is a double-effect evaporator. This operates at temperatures low enough to prevent conversion of the cyanides to carbonates. Maximum temperature of 180° F is maintained by vacuum in the first effect and a still lower temperature and higher vacuum in the second effect.

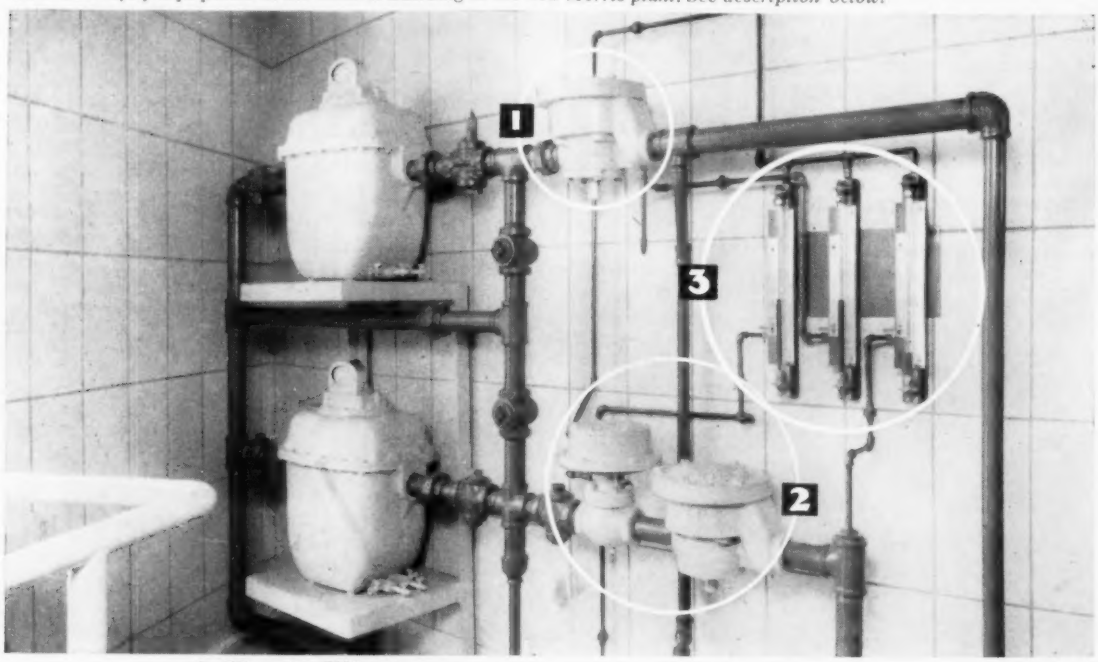
"Television Antenna Factory Recovers Plating Wastes." *Wastes Engineering*, January.

Special Conveyor Solves a Trench Backfill Problem

The Walter L. Follmer Construction Co. of Hamilton, Ohio, was awarded a contract to lay 2860 ft. of 54-in. diameter Armco corrugated sewer pipe down 15th Avenue in Middletown, Ohio. The street is thickly overhung by trees which were not to be moved or destroyed. Also, the sewer had to be laid down the center of the street at an invert elevation of approximately 16 ft. below street grade. Since the street was too narrow to permit enough side movement for shovels to load trucks, another method had to be used to move the dirt and backfill.

It was decided that a back-hoe and conveyor would do the job. E. F. Marsh Engineering Co. of St. Louis designed and built a 60-ft. powered conveyor. By using the conveyor it was possible to dig, lay, and back-fill simultaneously. A steel shield was used to protect the men in the ditch. House connections were placed before the pipe went into the trench; then the house line was connected. A front loader was used to clean-up after the fill was in. Floyd G. Browne & Associates of Marion, Ohio were the consulting engineers on the project.

PFT Gas Safety Equipment in the Control Building at the new Morris plant. See description below.



At Morris, Illinois...

A new plant equips for maximum protection

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The modern primary sewage treatment plant shown here began operations at Morris in March, 1955. Designed for a population of 9,600, it incorporates many features of "Controlled Digestion" in addition to a complete PFT gas safety system! Among the safety equipment items are:

(1) *PFT Flame Trap*—a heavy cast iron housing with aluminum flame arrester element prevents passage of flame. A thermal valve closes automatically at critical temperatures.

Plant Superintendent G. B. Reagen checks operation of the PFT #250 Heater & Heat Exchanger.

(2) *PFT Pressure Relief with Flame Trap*—the same flame trap features plus a pressure relief with diaphragm control. Maintains a safe, constant pressure at the digester and in the gas distribution system.

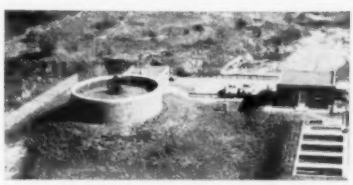
(3) *PFT Gas Pressure Gauge*—a 3 scale gauge indicates the pressure in various parts of the gas piping system. Top of gauge connects to vent manifold with flame checks.

PFT Drip Traps—four 2 qt. traps provide safe removal of condensate formed by warm gas passing through cooler piping.

Waste Gas Burner—an effective device that safely burns off all excess gas and prevents odor nuisance.

Additional equipment at the Morris plant includes: *PFT Floating Cover* for the 40′ digester; *PFT Heater & Heat Exchanger; PFT Supernatant Selector and Gauge* unit.

Morris' city officials and consulting engineers have created a fine plant that serves efficiently and economically. PFT is proud to have contributed its share to another modern sewage system.



Left, PFT Floating Cover on the 40′ digester. PFT prefabricated insulated roofing reduces digester heat losses.

Design of plant by / *Baxter & Woodman, Civil & Sanitary Engineers, Crystal Lake, Illinois*

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Determining Low COD of Surface Water

When estimating the organic content of stream samples, the wet combustion method involving the use of 0.25 N potassium dichromate as the oxidant, as applied to industrial wastes and sewage, has been found to be insufficiently sensitive. For samples containing 5 to 50 ppm of organic matter, the use of 0.025 and 0.05 N potassium dichromate was investigated. To obtain reproducible results, it was found necessary to use an acidified rinse water, to plug condenser outlets with glass wool, and to keep glassware scrupulously clean. When all steps in the procedure were carefully controlled, uniform results were obtained with the weaker dichromate solutions. The sample size should be so selected that not more than 50% of the dichromate is consumed in oxidation. When silver sulfate was used as a catalyst, it was found that a constant correction of 40 ppm should be made from the COD, provided the chloride content is between 40 and 300 ppm. Otherwise, chloride corrections are quantitative. In stream surveys, the COD-BOD ratios give information on general stream conditions, when obtained at representative points. While calculation of BOD values from COD results may be unreliable, when weather conditions and stream flows are constant, probable BOD range at a stream point may be estimated from previously established representative COD-BOD ratios.

"Determination of Low Chemical Oxygen Demands of Surface Waters by Dichromate Oxidation." By W. Allan Moore and W. W. Walker, Robert A. Taft Sanitary Engineering Center, Cincinnati. *Analytical Chemistry*, February.

Need for Water Pollution Control

The increasing dependence of communities on surface water supplies points up the need for conservation of water through pollution control. S. 890, presented before the last Congress, passed the Senate but failed to receive final consideration in the House. Some of its provisions caused controversy, particularly among State and interstate agencies. During the recess of Congress, these agencies are considering means of presenting a united front on amendments needed. Ten states enacted water pollution control legislation in 1955, and three agreed to favor industries with tax benefits if they spend money for pollution abatement. Many municipal ordinances provided for increased attention to local pollution problems. Research at the Robert A. Taft Sanitary Engineering Center involved developing or evaluating new techniques of measuring beryllium, chlorine dioxide, and radioactive materials. The Center also initiated studies on instrumentation for measurement of chemical oxygen demand. The National Technical Task Committee on Industrial Wastes, joining forces with the Federal Government, prepared an "Industrial Waste Guide to the Wool Processing Industry." Biological indices of pollution are receiving more attention as opposed to chemical and physical yardsticks. Control agencies, backed by several years of accumulation of data, are in a position to put pressure on those responsible to clean up wastes. Few statistics are available on expenditures by industry for pollution abatement, but many companies are spending six-digit amounts.

"Industrial Wastes." By S. T. Powell. *Industrial and Engineering Chemistry*, January.

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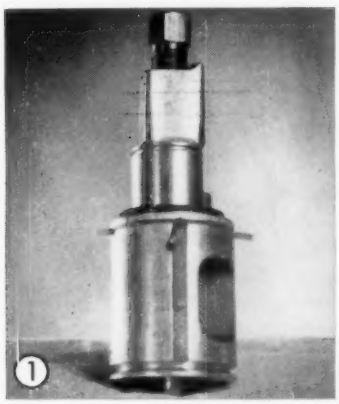
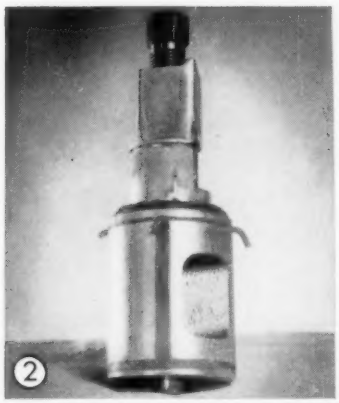
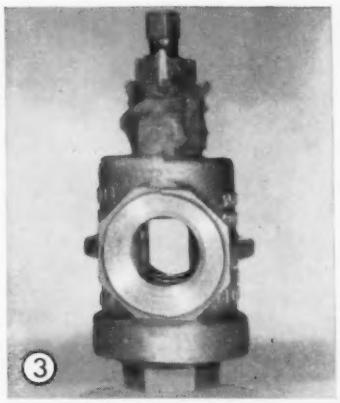


This plug was removed from a Homestead Valve just after starting lubrication, and before all sealing areas were filled with lubricant. Note that pressurized lubricant continues to extrude through feeder holes. Momentary downward movement of plug at start of each lubrication, gives assurance that plug is always free to turn.

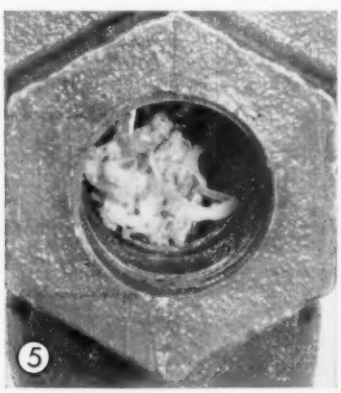


The plug was again withdrawn from the valve body just after a ring of lubricant around the stem indicated that the lubricant system was full. Note that all lubricant grooves are filled. The entire plug surface is coated with lubricant. Lubricant is well packed in the stem sealing area above the plug.



Now valve has been purposely over-lubricated as indicated by excess lubricant around stem. Note that with *controlled* pressurized lubrication there is no extrusion or seepage of lubricant into valve port opening. This means no waste, no contamination of line fluids, no clogging of low pressure lines with lubricant, or fouling of meters, orifices, etc.

Also, in the Homestead Valve with *controlled* lubrication, you will note that even though the valve has been over-lubricated, lubricant comes only to the bottom edge of the plug, and is not wasted by discharging in quantity into the bottom chamber.



Now, see for yourself the risk involved when a valve which does *not* have Homestead's *controlled* Pressurized Lubrication, is over-lubricated. Note lubricant has been forced into the port opening. It can contaminate line fluids, foul meters or orifices, or even block low pressure lines!

These are but a few of the many advantages of Homestead's controlled pressurized lubrication that guarantee lowest cost valve service.

Reference Book 39-5 has the full story—twenty-eight pages of engineering facts, sizes, types, dimensions, etc. Ask for your copy today. There is no obligation.

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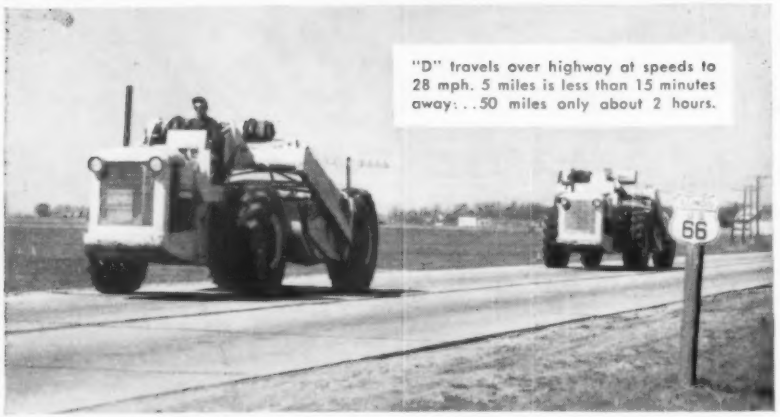

One man with "Handyman D" makes a complete dirtmoving crew!

The "Handyman D" is a 138 hp, 2-wheel, rubber-tired prime-mover coupled to an electric-control scraper of 7½ yards heaped capacity. Introduced in 1948, this machine has proved dependable and economical on more than 2500 earthmoving installations.

"D" loads itself, or can be push-loaded for production dirtmoving. It loads, hauls and spreads earth and other materials at low cost over long or short distances. Equipped with 8-ft. dozer blade, it also push-loads, clears land, backfills, removes snow, does other miscellaneous dozing.

Drives job-to-job

You don't need a truck-and-trailer to haul "D" to its assignments. There are no loading or unloading delays. The D Tournapull "runs" to the job via streets, highways, or cross-country, at speeds to 28 mph. Operator can drive rig out to work in the morning, bring it back to the shop at the end of the shift if desired.

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One "D Handyman" does grading, ditching, clearing, fills washouts, widens shoulders, builds access roads, handles land-fill garbage, stockpiles coal, loads, hauls, and spreads from sand and gravel pits, removes snow, etc. Versatility makes "D" economical on many kinds of work often done with special tools.

From back-sloping to ditching, grading or clearing, the do-it-all "D" saves money wherever it goes. "D's" self-load, push-load each other, or combine in fleets with tractor or grader pushers for production dirtmoving.

Out-produces other earthmoving combinations

Working speeds are faster, and operation is more flexible than with shovel-and-trucks or crawlers-and-scrapers. Traction and flotation are adequate to meet any footing conditions encountered. Exclusive power-transfer differential applies up to four times the pull to wheel on firmest footing; enables "D" to work in mud, sand, snow, and ice where no trucks could go.

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Treating Acid Wastes with Calcite

Experience in treating acid wastes at the Worcester, Mass., plant of the General Electric Co. by passage through upflow limestone beds has led to change from "size No. 2 calcite crystals" 2 to 3 mm in diameter to "Roll-Cal H," a high grade poultry limestone. The use of two limestone beds in series has proven to be sound practice. Application of 26 gal. per min. per sq. ft. of a waste having an initial pH of 3 through a 2-ft. bed of limestone gives efficient operation. The cost of this treatment was $0.17 per 1,000 gal. The extra cost of the high grade limestone is justified by its elimination of operational difficulties.

"Treatment of Acid Wastes with Calcite." By Vincent de P. Lukas, San. Engr., G. E. Co. *Sewage and Industrial Wastes*, November.

Ozone Factors in Air Pollution

Opposing views are held as to the importance of nitrogen dioxide impurities in ozone as factors in air pollution problems and in exposure to ozone used as an air sanitation agent. In an attempt to clarify the issues involved, a study was made of the data available in the literature, and these data were applied in testing the production of ozone from an ozonizer of the phenol-formaldehyde resin dielectric type. The questions to be resolved included determining which nitrogen oxides could be expected in ozone as ordinarily produced from air and how the amounts would be affected by different operating conditions of the ozonizer. Because of known toxicological effects and kinetic and equilibrium behavior in chemical reactions, all oxides of nitrogen except nitrogen dioxide, nitrogen pentoxide, and nitric acid vapor could be dismissed from consideration. Nitrogen dioxide was found to be only a small portion of the total impurity, and this was rapidly oxidized to nitrogen pentoxide in the presence of an excess of ozone. The nitrogen pentoxide was indicated to be hydrated in normal atmospheres to nitric acid vapor. The interpretations made of the toxicological results have thus far indicated that the nitrogen oxide impurities in ozone as ordinarily produced are not an important factor in the toxicity of ozone.

"Nitrogen Oxide Impurities in Ozone." By B. E. Saltzman, D. H. Byers, and F. L. Hyslop, U. S. Public Health Service, Occupational

Health Field Headquarters, Cincinnati. *Industrial and Engineering Chemistry*, January.

Determination of Anionic Detergents

While the Jones method with its modifications appears to be the usual procedure for quantitative estimation of anionic detergents in sewage, interference of thiocyanates, nitrates, nitrites, protein, and compounds in urine causes inaccuracy. A method more rapid and less subject to interference was developed by complexing the detergent with methyl green, extracting the complex with benzene, and measuring the absorbance of the benzene solution by comparison against a standard curve. Methyl green was chosen from a group of 13 dyes. Since the molecular weights of detergents found in sewage vary from approximately 250 to 300, sodium lauryl sulfate, having a molecular weight of 288 and capable of forming a complex with methyl green, was selected as a standard. Experiments were run to check the recovery of sodium lauryl sulfate from domestic sewage, from lake water, and from river water, and the results were compared with those of the methylene blue method of Jones and Faust. The data obtained from the experiments with sewage and lake water showed wider fluctuations in replicate determinations in the methylene blue method as compared with the methyl green method. The results with river water, on the other hand, were comparable between the two methods.

"Determination of Anionic Detergents in Surface Waters and Sewage with Methyl Green." By W. Allan Moore and Raymond A. Kolbeson, Robert A. Taft Sanitary Engineering Center, Cincinnati. *Analytical Chemistry*, February.

Oil Pollutant Investigations

Investigation of the presence of oil in surface water is frequently more complex than determining oil in an industrial waste. Concentrations are lower and interference is increased by the presence of domestic and other industrial wastes. Continuous liquid-liquid extraction with air agitation was effective for recovery of oil from nonhomogenous samples. The solvent used was carbon tetrachloride. Air flow countercurrently was found to improve the efficiency of extraction. Infrared absorption was measured for quantitative and classification purposes.

Landfill garbage disposal speeded by Tournatractor

Dirt from next disposal trench is dozed over compacted refuse. Tournatractor's blade carries 2½ cu. yds. of material.

Many American cities have solved their refuse disposal problems with sanitary landfill. This system eliminates odors, flies, and rat breeding opportunities and requires less equipment with lower operating costs than other methods of garbage disposal. On a long-term basis, it fills worthless land to convert it into valuable real estate.

On sanitary landfill work, LeTourneau-Westinghouse rubber-tired equipment has a big advantage over other machines.

With Tournatractor, for instance, you can use dozer blade or towed scraper to dig a trench. No shovel or trucks needed. No slow-moving crawlers. One man and one machine can do the complete trenching job.

For covering, Tournatractor also works alone to doze truck-hauled garbage into the trench, and to put on the desired layer of stockpiled dirt. If sufficient cover earth is not available nearby, Tournatractor's 19 mph speeds make practical long-distance dozing or hauling of cover. Because of this speed, job figures show that Tournatractor will do the landfill job 2 to 3 times faster than crawlers of comparable size.

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If you have a garbage disposal problem, ask your local Distributor for all the facts on the landfill method of refuse disposal. He will gladly help you plan a program that will get rid of the unsanitary conditions of an open dump, and, at the same time, give your community improved land which can be used for recreation, or be profitably returned to the tax roll through sale to private owners. Your local banker can probably help you set up a municipal corporation to finance this plan, so that you need not draw on current operating funds.

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Interference revealed by the infrared curve was removed by chromatographic separation and a corrected curve was obtained on the specific class of hydrocarbons. The method was found applicable in determining the amount, type, and condition of oily residues in the presence of mixed components in polluted water. The method was restricted to the relatively nonvolatile components that exhibit the characteristic infrared curves of saturated hydrocarbons, thus excluding such materials as fatty acid soaps, animal or vegetable oils, and coloring materials which may be associated with oils in a stream.

"Determination of High Boiling Paraffin Hydrocarbons in Polluted Water." By F. J. Ludzack and C. E. Whitfield, Robert A. Taft Sanitary Engineering Center, Cincinnati, *Analytical Chemistry*, February.

Detergent Research Related to Water and Sewage

F. J. COUGHLIN
The Proctor and Gamble Company
Chairman, Technical Advisory Sub-Committee on Research Association of American Soap and Glycerine Producers, Inc.

FOR SOME TIME those engaged in water supply and sewage treatment have shown interest in detergents. This interest seems to lie in the possible effects, if any, of the normal use of detergents on water supplies and in sewage treatment plants. Detergents are sometimes associated with problems of frothing, sedimentation, and coagulation difficulties in water treatment plants. In the treatment and disposal of domestic sewage, the normal use of detergents is said, in some instances, to cause frothing and to retard the biological processes of decomposition. The Association's research program undertakes to determine whether there is any connection between the difficulties reported and the normal use of detergents, and, if so, to what extent. These problems had existed before the advent of detergents and it would be expected that they would increase in severity as the population increases.

By way of definition, the term "detergent" is used in this discussion to refer to the complete product as it is found in the package on the grocery shelf or in barrels or drums for general bulk industrial uses. In homes, detergents have grown to where sales are well over half the total of all washing products. Detergents contain surface active agents sometimes referred to as surfactants, and in addition they may contain inorganic and organic builders. Of the surface active agents, alkyl benzene sulfonate, a derivative of petroleum, often referred to as ABS, is used more extensively than any other. The most important builders used are the complex phosphates. For those interested in further information on the characteristics and behavior of detergents, papers by Haney[1], Gowdy[2], and Hoyt and Flett[3], are recommended as they pertain to water and sewage treatment

To obtain the kind of suds that the housewife likes in her dishpan, she may use about 3,000 parts per million or three-tenths of one percent of the packaged synthetic detergents. This would be equivalent to about six hundred parts per million or six-hundredths of one percent of surfactant. Typical concentrations of detergent likely to be present in domestic sewage have been reported by Haney, with 53 parts per million as the highest value[1]. This would be equivalent to ten to fifteen ppm of surface active agent, assuming, for the purposes of obtaining a maximum figure, no decomposition or die-away. The concentration of surface active agent present in surface waters would therefore be considerably lower because of dilution effects.

Foam first reared its frothy head in sewage treatment plants long before the advent of detergents. Now, when the froth develops to photogenic heights, it is likely to receive considerable newspaper publicity which more frequently than not associates it with detergents. In 1947, references to frothing in sewage treatment plants began to appear in the technical literature and the trade press, and there was some speculation then about whether or not detergents might be the cause. However, it was assumed that sewage plants would be able to handle the relatively small amounts of detergents which would find their way into sewage even if usage was at a maximum. This seemed reasonable since frothing had occurred before the introduction of detergents, and since there are many other foaming agents which might very well be present in sewage or could be produced during the oxidation and decomposition of the sewage.

The first opportunity for the soap industry to offer help in a specific situation came early in 1951. At that time, a sewage treatment works developed a froth about eight feet high. Naturally, in Texas! San Antonio, to be exact.

There were no methods of analysis to determine how much detergent was present in the sewage or to evaluate the possible breakdown of detergents during treatment. San Antonio proceeded to make a study of their problem in which Procter & Gamble cooperated[4, 5]. Experiments showed that the froth could be produced or it could be made to disappear at will simply by lowering or raising the amount of activated sludge solids re-circulated through the aeration tanks. Furthermore, from detergent usage and from the amount of sewage treated, the quantity of detergents that might be present in the sewage was calculated. The concentration was so low that it was not conceivably capable of producing the kind of froth which developed. With 200 ppm of suspended solids in the aeration tanks, the frothing difficulty occurred. This froth was made to disappear through the simple expedient of raising the suspended activated sludge solids above a critical level of about 1400 ppm. At a high solids level of 3500 ppm even as much as 250 ppm of packaged detergent product did not create frothing. From this and much more evidence obtained in the San Antonio tests, it was reasonable to conclude that at least in this instance synthetic detergents were not responsible for the frothing troubles. The San Antonio experience was followed by difficulties which occurred a little later in New York, Philadelphia and Los Angeles. The principles developed at San Antonio were later verified at a smaller plant located at Bryan, Ohio, which operated under different conditions than San Antonio. Several detergent brands were added to the aeration tanks at Byran. In all cases, the addition of detergent to the tanks did not change the frothing picture.

The California Research Corporation saw the importance of developing fundamental information on the fate of ABS in sewage treatment processes and undertook a practical scale study. An unequivocal method of analysis was used, employing ABS tagged with radioactive sulfur. This work, reported by House and Fries at the New York Sewage and Industrial Waste Association meeting in New York City this past January, shows that in the activated sludge plant in which the tests were made, eighty to ninety percent of the ABS was destroyed by the normal sewage treatment process. This is the same effi-

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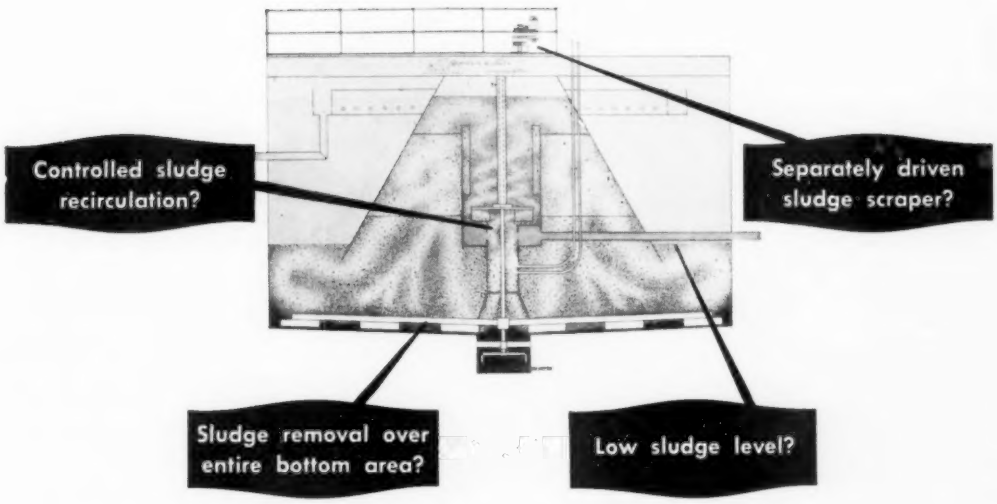
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ciency as obtained on normal sewage in this plant.

Water Treatment

In the water treatment area, the need for a more active program became apparent when the quiet on the waterfront was disturbed at Wheeling, West Virginia, in the fall of 1953. Large quantities of froth formed on the Ohio River and in the water treatment plant there. The froth was accompanied by bad taste, discoloration, and extreme difficulty with filtering and settling. The river had been at an extremely low stage and almost in pool. This low flow brought about the presence of high concentrations of various organic and inorganic substances in the river water. When frothing occurred, the river water appeared to contain about one part per million of "apparent ABS", using the Methylene Blue procedure which includes any interfering substances present. With such a low level of ABS in the water, it was extremely difficult for anyone to postulate how detergents might have produced the foam. On the other hand, the foam contained a high concentration of ABS which was present chiefly on finely divided solids held and suspended in the foam. This, while difficult to explain, was still not conclusive. Since that time, incoming water with the same concentration of ABS by the Methylene Blue method has been treated by the water works at Wheeling without any trouble. In retrospect, a fair and reasonable point of view seems to be that detergents from domestic sewage were not the principal cause of the Wheeling froth, if indeed they had any appreciable effect at all.

Phosphates—More recently, in instances where water treatment plants have encountered difficulties with coagulation and sedimentation, there has been some speculation that the complex phosphates from household detergents might be involved. It is true that if enough complex phosphates are present, they could retard coagulation and sedimentation in water treatment. In fact, it is because of this particular property that these materials have become such an important constituent of household detergents. However, before the conclusion is reached that they cause such troubles, there should be an answer to the question: "Are the complex phosphates or other phosphates present in sufficient concentration in the surface waters going into the water treatment plants in question to produce the effects reported?" A committee has been organized to study the question of phosphates. In addition research is being supported at four universities. M.I.T. is studying the possibilities of biochemical degradation of detergent surface active agent; the University of California is studying the fate of the ABS in sewage treatment using radioactive tracer techniques; Wisconsin is studying the cause of frothing in sewage treatment plants; and Illinois is determining if detergents have any effects in water treatment processes.

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4. "Froth Formation and Synthetic Detergents", by W. N. Wells and C. H. Scherer — Sewage & Industrial Wastes, Vol. 24, No. 5, May 1952, Pages 670-679.
5. "Action of Detergents in Sewage

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Treatment—A Study by Industry", by W. R. Gowdy—Sewage & Industrial Wastes, Vol. 25, No. 3, March 1953, Pages 255-261.
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• • •

Sewer Cleaning Program Produces Results

A sewer cleaning program in Cuyahoga Falls, O., over the past four years, has removed more than 200 tons of debris from the sewers. The 1955 work covered 40,143 ft. of sewers, practically all 12-in., or smaller, and removed 63,660 lbs. of debris.

• • •

Iron and Manganese Removal

(*Continued from page 92*)

Aluminum sulfate is the coagulant usually employed and this works best generally at a pH ranging from 5.5 to 6.8. It can not be too strongly stressed that the coloring matter in high color waters is not one single substance; that organic matter varies greatly in nature not only in different waters but also at various times in the same water; and that the best way to find out what can be accomplished is by running a series of jar tests on freshly drawn samples.

Chlorine will exert a marked bleaching action on some high color waters but has little effect on others. Whatever bleaching action it may effect will be realized when the breakpoint is reached and dosages beyond this are useless. With some of these waters, chlorination will also precipitate some of the iron but in most cases, coagulation, settling and filtration are also necessary.

Ferric Hydroxide

Suspended ferric hydroxide will be found in iron-bearing waters where it was originally present in solution as ferrous bicarbonate, first, if from a shallow well; second, if an open storage tank is employed and third, if the water is pumped by an air lift. In all these cases, the ferric hydroxide has been formed by the oxidizing action of the air on the ferrous bicarbonate. Such waters are discolored and turbid.

The first two conditions were well illustrated by two Indiana municipalities. In one, the water supply was drawn from shallow wells. This water contained a considerable content of ferrous bicarbonate and, although the wells were covered, the oxidation was sufficient to form a very considerable amount of fer-

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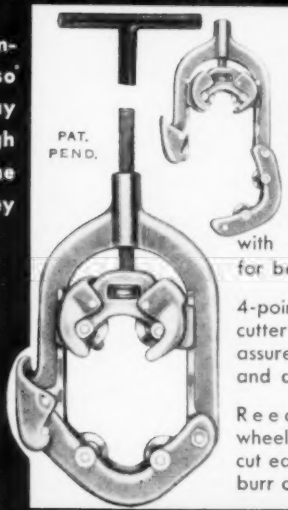

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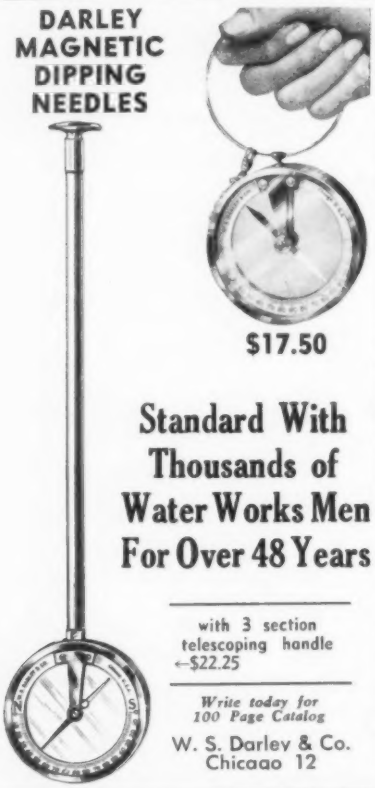

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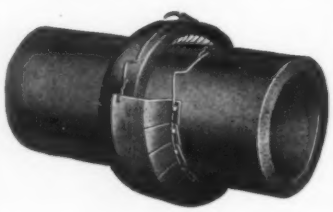

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ric hydroxide, some of which was precipitated in the wells and the rest of which was carried into the mains. In the other, the iron-bearing water was obtained from deep wells but a reservoir, floating on the line, served to oxidize some of this ferrous iron and the water from the distribution system, at times, would discharge as a coffee colored fluid which, on test, was found to contain as high as 70 ppm of suspended ferric hydroxide.

In such cases, both suspended ferric hydroxide and soluble ferrous bicarbonate are usually present as the amount of air dissolved is generally small and only a partial oxidation has been effected. Therefore, the first step in the treatment is to effect a thorough aeration so that the soluble ferrous iron will be converted to the insoluble ferric form. Then the entire iron content can be removed by settling and filtration.

In the third case, sufficient aeration has usually been effected by the air lift and generally all that is necessary is to remove the insoluble ferric hydroxide by settling and filtration.

Suspended ferric hydroxide may also be formed by the action of a corrosive oxygen containing water on the ferrous metal of the distribution system. The remedy obviously lies in inhibiting the corrosive action and the most widely used remedies are (1) if the water has a sufficient calcium content, treat it so that the Langelier Index is slightly on the positive side; or (2) feed a caustic silicate solution to the water (about 1/10 lb. 40°Be normal silicate of soda (common water glass) per 1000 gal. plus enough caustic to raise the pH to about 8.3). Another method, which has been used more in industrial than municipal applications is to reduce the causative agent — dissolved oxygen—to a low figure (0.3 to 1.0 ppm) by means of a vacuum deaerator.

Iron Pickup

Iron pickup in municipal practice usually occurs when a new, air-free water supply is pumped through an old, tuberculated distribution system. Under such conditions, the metal of the piping slowly reduces the hydrated ferroso-ferric and ferric oxides to the ferrous state and some of the product then goes into solution as ferrous bicarbonate.

While free carbon dioxide, if present in sufficient amounts, accelerates the reaction and also furnishes the carbon dioxide needed to form the ferrous bicarbonate, it is not theoretically necessary, for both ferrous carbonate and ferrous hydroxide are appreciably soluble. In fact, expressed as iron, the solubility of ferrous hydroxide is 4.2 ppm and that of ferrous carbonate is 31 ppm.

The obvious remedy for iron pickup is to put a little air in the water to keep the tubercles from being reduced to the ferrous state. It doesn't need to be saturated with air; a very small amount will usually be found to be sufficient. Then a caustic silicate feed may be used to overcome corrosive tendencies or, if there is sufficient calcium present, the Langelier Index can be adjusted so that it is slightly on the positive side.

• • •

Brackenridge Power

(*Continued from page* 112)

plant of $28,189.61, or an average of 5.37 mills per kw. hr.

In terms of thermal efficiency, the performance of the three Fairbanks-Morse engines is even more interesting. The pilot oil used at Brackenridge is 39.7 grav. API, and has a heat value of 135,924 btu per gal. The natural gas used has a guaranteed heat value of 1,000 btu per cu. ft. By averaging 10.11 cu. ft. of gas per kw. hr. and .0101 gal. of oil per kw. hr. throughout the period, the three engines achieved an average of 11,482 btu per kw. hr. Since each unit operates often at a load factor of 60 percent or lower, it is expected that this average will improve considerably as the demand increases. At the present time the load placed on the plant frequently reaches 800 kw., which means that two 675-kw. units have to be placed on the line. Lube consumption during this period totaled 2915 gals. for an average of 4,607-hp. hrs. per gallon.

The problem of providing qualified operators was solved with the help of the engine manufacturer. While construction was still going on, a Fairbanks-Morse engineer held "school" for five prospective operators, including a plumber's helper, a truck driver, a street department laborer, and two former linemen for the Borough's water and light department. These men were instructed in the basic design of the opposed-piston engine. They were taught how to assemble and disassemble the various engine components, how to read temperatures

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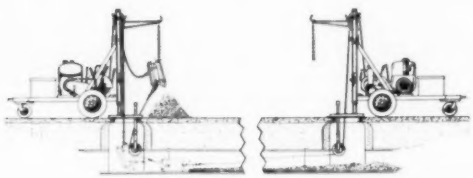

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and pressures and how to operate and maintain the auxiliaries.

No. 2 diesel oil is delivered at the Brackenridge plant by truck and is unloaded into two 10,000-gal. underground storage tanks. Natural gas arrives at the plant at a pressure of 6 lbs. and is boosted to 36 lbs. before reaching the engines. The compressors are cross-connected so that any engine can be served by any compressor or combination of compressors. In this way a single compressor can be used to serve two engines up to 1,000 kw.

Makeup water for the jacket water system of each engine is drawn from the city mains and is softened and treated before use. It is circulated through each engine by a built-in, engine-driven pump, which sends it through one of two horizontal radiators, through the lube oil cooler, and then back to the engine. An automatic control valve by-passes about 2/3 of the jacket water around the radiators from approximately 170° F. to 120° F. This cool water keeps the temperature of lube oil leaving the cooler at a constant 180° F. Each radiator is equipped with a 108-inch copper-blade fan, driven by a 15-hp. two-speed motor.

Scavenging air for each of the two-cycle O-P engines, drawn from the outside through an oil-bath type filter on the lower roof of the plant and through a silencing elbow, is supplied to the cylinders by a built-in, positive-displacement type blower. Starting air is supplied at a pressure of 250 lbs. by two reciprocating compressors, one driven by a 7½-hp. motor and the other used in emergencies, by a 4-cycle gasoline engine. It is stored in three 20-inch by 72-inch receivers.

At the control end of each engine is a compactly arranged gauge board, containing pressure gauges on scavenging air, starting air, and duplex pressure gauges on gas, lube oil filter and lube oil strainer. There are both gauges and a 24-hour recording meter on lube and jacket water temperatures. Also installed on the board are an alarm panel, with visible and audible alarms on jacket water pressure and temperature and lube oil pressure and temperature; a multi-point exhaust pyrometer, and a control switch for the respective pre-lubrication pumps.

To provide for economical heating, a motor-driven booster pump circulates warm jacket water through three unit heaters located throughout the building. The fan in each heater can be used to circulate cool air through the plant during the hot summer months.

Power is distributed at an 11-panel switchboard, equipped with a swinging synchroscope and solenoid-operated circuit breakers. These circuit breakers operate on d-c current and are of the drop-out type, for easy removal. There are three a-c and three d-c generating panels on the board, one metering panel and four distribution panels. The a-c panels are equipped with kw. meters and a.c.m. meters, and the d-c panels with meters on amperage, alternator temperatures and engine hours. On the swinging synchroscope are line voltage meter and an incoming generator voltage meter.

• • •

County Road Building

(*Continued from page* 124)

The Waterville North project was a pure and simple widening job on a four-mile section. Ten miles of the fourteen-mile road has a 26-foot, well ballasted subgrade with a 20-foot light bituminous surface treatment mat. The other four miles had only a 24-foot subgrade, no ballast, and a 14-foot wide oil mat. The

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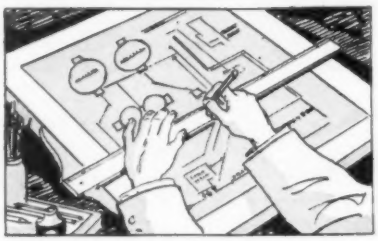

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problem was complicated by the fact that right-of-way was only 40 feet as grain elevators and other buildings had been constructed adjacent to property lines and the Board of County Commissioners had no desire to condemn 10 feet of right-of-way on each side.

The problem resolved into one of creating a 26-foot subgrade within the 40-foot right of way limits. Fortunately, the soil is a very highly compacted solid clay capable of standing vertical or on a ¼:1 slope. Cuts were bailed out and the muck used to widen fills. Motor patrols gained what backslope was possible, then rebuilt the ditch in the required position.

A truck shovel did not prove too satisfactory here since this machine must work parallel with the ditch. The need was for a machine working perpendicular to the ditch, getting the steepest possible slope as close to the right-of-way line as structures permitted.

A Pettibone - Mulliken 1¾ - yd. loader proved to be excellent for this work. With the lowering ability of the bucket, the machine can dig below its own level, thereby producing the rough ditch form. This, in turn, gave the patrols more opportunity to shape the grade.

Cramped quarters did not appear to bother the machine. It easily handled four 5-yard dump trucks on very short hauls with no bog down production. The machine further proved its versatility in that it also trenched readily for culvert extension.

The final type of force account causing us the most trouble is on short street bituminous paving in the river area. This was, originally, an orchard area. The sudden influx of industry made building and selling more profitable than apples. With no planning commission in operation, plotting got a bit out of hand before controls were instituted. Consequently, we ended up with many short dead-end, and mismatched streets 600 to 800 feet long. Such an arrangement is not conducive to cheap contract prices. Each piece of equipment has to come before the next goes in, leaving no opportunity for speedy operations. For single-lift penetration, we did best by running a double roller system. A patrol tight blades the surface, followed immediately by a 10-ton smooth tired roller; then by the oil shot and cover stone, and finally by an 8-ton smooth tired roller. Meanwhile, the first units have moved on to the next short street. We bunch each job into one area as much as possible. For this

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type of operation, we have found the tailgate chip spreader most satisfactory. There are too many moves and too much handling for the conventional trailed spreader to function efficiently.

These are the force account types providing most of our headaches. They are proof that not all county work is most efficiently contracted. Some have to be worked out piece by piece as you go, fitting the projects together like a gigantic jigsaw. I have come to the conclusion that county engineering must be a labor of love. That is the only explanation for so many good men being in it.

• • •

Sewage Treatment Plant for a Farm Colony

(*Continued from page* 114)

hydraulic loading is 26.6 million gallons per acre per day; the media is Birmingham slag 2-in. to 3-in. in size and the average filter media depth is 4 feet.

The secondary clarifier is designed for a two-hour detention period at average rate of flow. A recirculating launder is provided from which the 200 gpm recirculating pumps take suction. After leaving the secondary clarifier the sewage is chlorinated at the rate of 125 pounds per day at peak flow. This is accomplished by a 400 lb./24 hr. Wallace & Tiernan, chlorinator, float and differential converter controlled by the differential head on the outfall weir. The existing Imhoff tank was converted into a chlorine contact chamber; it provides approximately one hour detention at the four-hour peak rate of flow.

Fifteen contractors submitted bids for this new construction, and total project bids ranged from a high of $212,120 to the $134,950 low bid by Bumby and Stimpson, General Contractors, Orlando, Florida. After deducting for alternates the contract was let to the low bidder at a cost of $131,279. Total contract time for the project was 240 days.

Operational results of the sewage treatment are not as complete as had been expected but the plant has been in operation for only eight months, and the operators employed were not experienced. However, with a flow of 250,000 gpd in October, three tests showed an effluent BOD of 11, 23 and 11 ppm; the raw sewage BOD was 110, 176 and 205.

This article is taken from a paper presented by Mr. Shields at the FSIWA and AWWA meeting at Orlando, Florida, last fall.

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EQUIPMENT NEWS

Published Monthly March, 1956

Bulky Refuse is Crushed in New Speed-Packer Unit

The Speed-Packer collection unit which shreds and crushes refuse, then compacts it, has been introduced by Gar Wood Industries, manufacturer of the Load-Packer. The new unit is a continuous loader. Refuse dumped into the hopper is crushed into easily compacted fragments as fast as the loading crew can load it. Even large objects, such as packing crates and tree branches, are quickly and easily crushed, then fed into the body and compacted. During demonstrations the Speed-Packer chewed its way through a continuous flow of tin cans, automobile tires and 2 x 4's. A bigger payload results since all refuse is broken into small pieces before entering the body and is more easily compressed. The Speed-Packer's highly compressed loads are said to be extremely easy to incinerate.

Tires, lumber, bricks and heavy brush are all crushed in the Speed-Packer

Shredding is accomplished by steel crushing teeth—46 in all—located in the crushing chamber at the bottom of the loading chute. Refuse dumped into the 54-inch wide chute slides down into the crushing chamber and is caught by the revolving teeth which exert a pressure of 5000 pounds each. The Speed-Packer will load and compact virtually anything that fits into its spacious loading chute. Even tires, junked bicycles and cinder blocks are quickly crushed and carried into the body for compaction.

Once the refuse has been processed in the crushing chamber, it is fed into the collection body and is ready for compaction. The mechanics of the Speed-Packer's compaction are similar to those of the Load-Packer. The complete compaction cycle lasts only four and a half seconds, and cycling is controlled by the operator who simply presses down on the safety bar. This safety bar runs the full width of the hopper, allowing crew members, at the slightest touch, instantly to stop the rotation of the crushing teeth. Since the Speed-Packer's crushing teeth rotate in a direction away from the operator, all refuse is crushed in a downward direction. This is an important safety feature too, as it eliminates the danger of flying glass or debris.

The unit is surprisingly simple to maintain and service. A simple chain and sprocket arrangement, driven by a hydraulic motor, operates the crushing teeth. Located in a closed compartment above the loading chute, the mechanism can not be clogged by rubbish. Neither maintenance nor servicing require special tools or equipment. Power for the hydraulic motor is supplied by a conventional power-take off and pump arrangement.

Complete information on the Speed-Packer is available from Gar Wood Industries, Inc., Wayne, Michigan. Circle **No. 3-1** on the reply card.

Loading Speed-Packer chute. Units are being made in 16 and 20 cubic yard models

Five New G-E Fluorescent Luminaires

General Electric is now producing five new fluorescent luminaires designed to answer virtually every urban and highway lighting need. The luminaires range in length from two to seven feet, and in light output from 2,700 to 64,000 lumens. The smallest of the new units uses two two-foot lamps and is designed for lighting residential streets. The largest is a seven-foot, 12-lamp luminaire designed for "whiteway" applications. The construction of luminaires is basically the same in all five sizes. Each unit is designed for mounting on a pipe tenon entering through a slip fitter casting. This pipe terminates in a second casting arranged to permit a leveling adjustment of three degrees. For further information write Section 452-166, General Electric Co., Schenectady 5, N. Y., or circle **No. 3-2** on the reply card.

John Bean Rotomist Cuts Shade Tree Spraying Costs

Design features of the John Bean 100-E Rotomist include an improved combination of jet and mechanical agitation for thorough mixing of spray materials in the tank; airplane-type control column; and new engine and unit mountings to increase operating stability. A 29-inch axial flow fan, housed in a "straight-through" air delivery unit, discharges 28,000 cubic feet of air per minute at 100 mph velocity. The spray system includes a plunger-type pump that delivers 7 gallons per minute at 400 pounds pressure; one large cone-type nozzle that is easily detached to allow adjustment to the desired flow; and a 100-gallon tank made of heavy gauge steel. The op-

Shade tree protection and insect control are easy jobs with the Rotomist

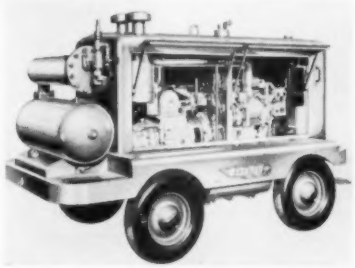
erator gets accurate "on-target" delivery with hydraulic controls that rotate the turntable 360 degrees right or left and vertically aims the counter-balanced discharge outlet through a 110 degree arc. For complete details write to John Bean Division, Food Machinery and Chemical Corporation, Lansing 4, Mich., or circle **No. 3-3** on the reply card.

New 100 to 125-yd Crusher

A newly designed 100 to 125-yd. per minute single pass, mobile crushing plant has been announced by Eagle Crusher. The key unit is the Eagle 18 x 36 roller bearing jaw crusher. Stone is fed into the hopper from which a 30″ x 36′ feed conveyor (with swing of 150° arc) discharges onto a scalper screen. Both feed and discharge conveyors are powered independently of the crusher for more flexible operation. The 10-ton jaw crusher has a one-piece electrically welded frame and the jaw can be adjusted to turn out 1-in. to 5-in. material. For highway travel the discharge conveyor folds back over the crusher and the feed conveyor is hauled by a separate truck. For full details write Eagle Crusher Co., Galion, O., or circle **No. 3-4** on the reply card.

Jaeger Air Compressor

This newest Jaeger Roto Air Plus unit delivers 365 cfm of air per minute. It is useful for gunite work and heavy duty sand blasting; or for operating a heavy duty wagon drill and a hand-held rock drill simultaneously. Instead of the usual 1800 rpm its full load speed is 1700 rpm, with resultant fuel savings and lengthened engine and compressor life. Eight-hour fuel tank, adjust-

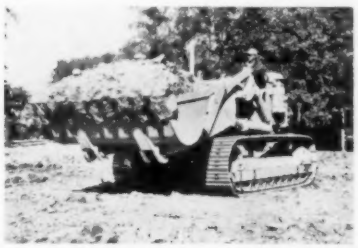


265 cfm Jaeger Roto Air Plus compressor is powered by a diesel engine

able radiator shutter, wrap-around bumpers and automotive-type steering front axle are standard. Complete information may be obtained by writing Jaeger Machine Company, Columbus 16, O., or circle **No. 3-5** on the reply card.

Big Traxcavator Model Has 2¼-Yd. Bucket

Utilizing a 2½ cubic yard bucket, Cat's No. 977 Traxcavator features include unit design, 40° bucket tip-back at ground level; good horsepower-to-weight ratio; advanced hydraulic system; large lifting capacity; good balance and stability; improved operator convenience and visibility; fast response to controls; in-seat starting; and oil flywheel clutch. Powered by a diesel engine with a gasoline starting engine this 100 hp Traxcavator has forward speeds up to 651 feet per minute and reverse speed up to 616 feet per minute. For more information write Caterpillar Tractor Co., Peoria, Ill., or circle **No. 3-6** on the reply card.



40° tip-back of bucket retains loads

Huber-Warco Announces Two New Graders

Two new motor graders featuring a torque converter and full power-shift transmission, the 140-hp of Huber-Warco 7-D and the 100-hp Huber-Warco 6-D, are being announced by Huber-Warco. The power-shift transmission permits quick shifts under full load at wide-open throttle without interrupting power flow. Complete hydraulic control of every working position—entirely governed from the cab—is another important feature. The operator can attain a bank-sloping angle up to 90° on either side. The blade can be rotated 180° without removing the scarifier teeth. Other features include an all-welded frame with high-arched design to give more space for blade movement and better visibility of the blade area, an extra heavy front axle with the steering knuckle made from a heat-treated steel forging, a heavy-duty final drive with all gears and shafts forged of heat-treated steel and interchangeable hydraulic cylinder components. For details write Huber-Warco Company, Marion, Ohio, or circle **No. 3-7** on the card.

Mobile crushing plant set up for processing base material

140-horsepower Huber-Warco 7-D grader tackles heavy jobs

Quick and convenient handling of heavy loads is possible with the telescoping boom of Pitman Model 60 Hydra-Lift

Four-wheel drive on this utility truck gives traction for snow plowing, backfilling and blade spreading jobs of many kinds

Hydra-Lift Unit Has Hydraulic Telescopic Boom

A boom that will telescope hydraulically with a full-capacity load is one of the improvements in the new Model 60 Pitman Hydra-Lift. The Hydra-Lift installs on any truck 2 tons or larger and boom loads can be positioned in almost any spot. The hydraulic boom telescopes from 17 to 27 feet and the standard tubular boom telescopes manually from 12 to 17 to 22 feet. It is shipped as a package unit and can be quickly installed. It is useful for water works, sewage plants and county and state highway maintenance departments. For full details write Pitman Mfg. Co., 300 West 79th Terrace, Kansas City, Mo., or circle **No. 3-8** on the reply card.

New Transistorized Sound And Leak Detector

Detection and amplification of a wide variety of industrial sounds is made possible by a new pocket size, transistorized audio-amplifier by Fisher. Location of causes of sounds caused by fluid leaks in radiant heating systems and buried pipelines, and by defective bearings or other moving mechanical parts, are just a few of the many applications. Power is supplied by a single, small dry cell battery good for approximately 100 hours of normal use. For further information write Fisher Research Laboratory, Inc., Palo Alto, Calif., or circle **No. 3-9** on the reply card.

Audio-Scope by Fisher amplifies the sounds of leaks in buried pipe lines

New Warning Light

Neo-Flasher announces a new line of warning light specifically designed for Municipal and Public Utility use. The Model A-100 is a flashing light operated by dry cell batteries. It is equipped with a 7″ directional head which is light in weight and can be elevated 8 ft. to 10 ft. in the air. Beside the directional head, an alternate head with 360° lens is also available. For further information write to Neo-Flasher Manufacturing Co., Inc., 3210 Valhalla Dr., Burbank, Calif., or circle **No. 3-10** on the reply card.

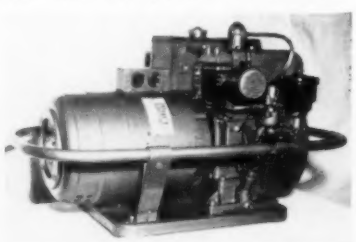
Workmen are safer when they use a flashing warning light

IHC Utility Truck for All-Around Work

The utility of the new International four-wheel-drive truck, model S-120, has been extended for both winter and summer service by attachment of a snowplow and backfill blade. The blade is controlled from the instrument panel of the truck and it can be centered for straight plowing, or angled to either side. An automatic trip mechanism protects both blade and truck from damage by hidden solid objects. The unit may be used to backfill trenches; spread topsoil, sand, or gravel; or perform leveling jobs where heavy-duty machinery is not required. Installation of the assembly is simple. For full information write International Harvester Co., Motor Truck Div., 180 N. Michigan Ave., Chicago 1, Ill., or circle **No. 3-11** on the reply card.

Katolight Introduces New Utility Line Of Portable AC Power

Four models are available of a new series of lightweight portable AC power plants in sizes of 1000, 1500, 2500 and 3500 watts. Weights range from approximately 90 pounds on the 1000 watt model to less than 280 pounds on the 3500



Power for emergencies and construction work is furnished by this unit

watt model. Units are equally adaptable for dependable emergency service or to operate labor saving power tools for maintenance or construction operations. For further information write Katolight Corporation, Box 891, Mankato, Minn., or Circle **No. 3-12** on the reply card.

New Lighting Standard for Fluorescent Luminaires

Newest addition to the Millerbernd line is the fluorescent "Elite." This standard is designed especially to accommodate the new slip-fitter type of fluorescent luminaire. Mounted at a five-degree angle, the luminaire

The graceful "Elite" standard is designed to mount fluorescent units

extends 24 inches onto a 2-inch pipe extension of the five-foot davit-type mast arm. The simplified design utilizes high-strength steel throughout, and is available in all popular mounting heights. For more data write Millerbernd Manufacturing Co., Winsted, Minn., or circle **No. 3-13** on the reply card.

Power Unit for Pipe Threaders

The "Porta Drive" power unit for pipe threaders announced by Muncie Gear Works, has a 20 to 1 gear ratio and is designed to power all standard geared pipe threaders. The unit is reversible and threads 1 to 2-inch pipe using adapters and will thread 2½ to 6-inch pipe with or without a vise. Weighing only 14 lbs., it can be used on the average shop work-bench and in the absence of power can be operated with an ordinary carpenter's brace. It also can be used to pull cable and to operate pulleys, hoists and conveyors. For full details write Muncie Gear Works, Inc., Muncie, Ind., or circle **No. 3-14** on the card.

Koehring Cruiser Crane Has 21 mph Travel Speed

Production of a "Cruiser" crane version of the Model 205 excavator has been announced by Koehring. One-man operated, the crane has a 15-ton lift capacity, ½-cu. yd. dipper capacity and a top travel speed of 21 mph for fast shuttle operation. It can negotiate 25 percent grades.

Its mobility suits the machine for many municipal and utility services in water and sewage warehouse and storage yards and in large area installations where equipment must be shifted quickly from one job location to the next. Features include power steering, air-hydraulic brakes and a standard torque converter. The unit has a short turning radius of 27½ feet and the all-welded chassis provides ample stability for crane and clamshell work. More detailed information from Koehring Company, Sales Office, 3026 West Concordia Avenue, Milwaukee 16, Wisconsin, or circle **No. 3-15** on the reply card.

Clean-cut trench sides in concrete pavements start with sawed outlines

Concrete Saw Speeds Cuts

The model CS-500, Champion concrete saw has a 14.6 h.p. air cooled gasoline engine, and is especially efficient for trenching, patching and highway work. Exclusives of this saw are dual blade guards, balanced construction so the saw can easily be tilted backward or forward for fast alinement, a front guide that can be lifted from the operator's position at the dashboard and a direct drive power unit. Other features include a double end spindle so you can cut in either direction along walls and obstructions, a positive screw action for raising or lowering the blade, and genuine four-wheel suspension, so the cutting line is not disturbed if one wheel moves up or down. For additional information write The Champion Mfg. Co., 2028 Washington Ave., St. Louis, Mo., or circle **No. 3-16** on the card.

"Four-in-One" Skid-Shovel Mounts on TD-14 Crawler

A new 2¼-cu. yd. "Four-In-One" Skid-Shovel, companion tool for the 75-hp International TD-14 crawler tractor, has been announced by Drott. This versatile unit, operated hydraulically, can be converted instantly from Skid-Shovel, to bullclam to clamshell, or to bulldozer, by operating a small lever. The new unit, when operated as a Skid-Shovel, gives a pry-over-shoe break-out action of over 17,000 lbs., plus a 42° ground-level bucket roll-back and will dump with a 9-ft. clearance. For use as a bulldozer, the 94-in. blade has a cutting edge and shoes that ride on the ground, and the depth of cut is regulated by a hydraulic radius control. Operating as a bullclam, the clam becomes a depth gauge. As the bullclam is pushed ahead, material boils into it and fills to a heaping load. Opening the bullclam wide makes it possible to operate the "Four-In-One" as a clamshell. For full data write Drott Mfg. Corp., Milwaukee, Wisc., or circle **No. 3-17** on the reply card.

Precision bulldozing is one of four operations handled by a Skid-Shovel

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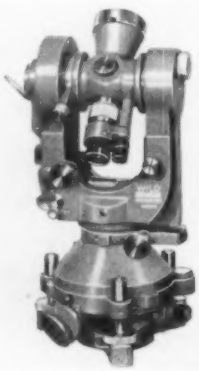
The Wild T-2 Universal Theodolite is adapted for all triangulations to the third and second order, and for precise surveys of every kind. Features include an extremely clear telescope with internal focus and coated lenses, reversible both ways, with signals aimed at distances up to 12 miles. Ten accessories, electrical illumination, and distance measuring with use of the Wild In-

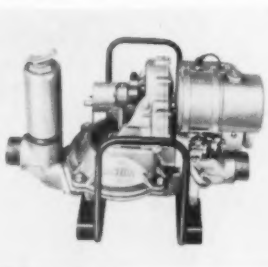


Precise surveying tool—the Wild T-2 Universal Theodolite

var Subtense Bar are designed to reduce to a minimum both the number of personnel and time spent on field parties. Clear and simple circle reading is achieved with a single microscope alongside the telescope and direct reading to 1 second is obtained on both circles. More details are available from Wild Heerbrugg Instruments, Inc., Main at Covert Streets, Port Washington, N. Y., or circle **No. 3-18** on the reply card.

Compact New Diaphragm Pump

All heavy-duty pumping—mud, muck, sand and sewage—is said to be easily handled by a new diaphragm pump just announced by Homelite. It has a pumping capacity of 5,000 gallons per hour. Weighing only 120 pounds and economical to operate, the new pump will run 6 hours at full capacity pumping on 1 gallon of fuel. Completely self-priming, it will dry-prime up to 15 feet and do it in 15 seconds. Supplied with 3" fittings, it can be adapted for use with 2" hose. For further information, write Homelite, 75 Riverdale Avenue, Port Chester, N. Y., or circle **No. 3-19** on the reply card.



Homelite diaphragm pump weighs only 120 pounds, has 5,000 gph capacity

Stainless Steel Well Points

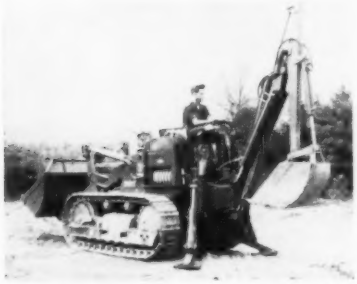
A well point developed by Johnson, made of type 304 stainless steel, is exceptionally strong to resist heavy driving. It has the corrosion resistance of the high-grade 18-8 stainless alloy. These well points are made with continuous slot openings for maximum inlet area per foot of length and the V-shaped slots are non-clogging. They are furnished in sizes to connect to 1¼-inch, 1½-inch and 2-inch standard pipe and are manufactured with any length screen and with any slot opening from 0.006-inch to 0.125-inch in width. For further information write Edward E. Johnson, Inc., 315 North Pierce St., St. Paul 4, Minn., or circle **No. 3-20** on reply card.

Oliver Crawler Tractor Features "Power-Turn" Steering

Announcement is made by Oliver of an improved Model OC-18 crawler tractor powered by an Oliver diesel engine delivering 161 hp and

Tight turns are made with ease by the Oliver Model OC-18 crawler tractor

weighing 32,500 lb. The new "Power-Turn" steering principle permits operators to make spot turns or gradual turns of any angle. Without shifting the operator can decrease speed by 38 percent to increase drawbar pull or push up to 60 percent, depending on weight and traction. Four levers provide full maneuverability and require only finger-tip pressure. A wheel system featuring anti-friction bearings is also available. For further information write The Oliver Corp., 400 West Madison St., Chicago 6, Ill., or circle **No. 3-21** on reply card.



Wain-Roy back hoe has actuated wrist-action bucket to hold level grade at trench bottom, make vertical sides and square corners. Check **No. 3-22** or write Wain-Roy, Hubbardston, Mass.

Tile Clip Improves Drain Line Installation

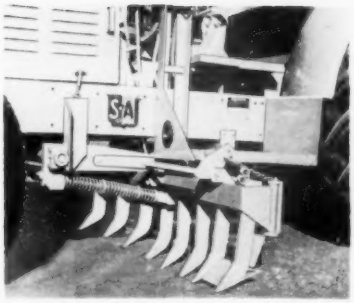
The possibility of clogged drain tile lines due to displacement or decay of tar paper joint covers is avoided by use of the Boco tile clip. Molded of corrosion resistant polyethylene plastic, the clips feature internal lugs that automatically space adjoining tiles ⅜" apart; snugly fitted joint covers; snap-on action and guide fins at the top to speed accurate installations. Full data from Boco Industries, Inc., 19424 W. Eight Mile Rd., Detroit 19, Mich. Circle **No. 3-23** on the reply card.

Multi-Purpose Self Loader for Trucks

A hydraulic truck loader that has a wide use in industry, municipalities and construction has been announced by LoDal. With a 3000-lb. capacity it fits most trucks from 1½ to 4 tons capacity, with special models for trucks over 4 tons. It is used for loading sand or gravel, snow removal and ice control, highway maintenance, construction cleanup, landscaping and filling; for street sweeper pickup and rubbish and garbage collection, and loading leaves. For full details write LoDal, Inc., Norway, Mich. or circle **No. 3-24** on the coupon.

Motorola "Handie-Talkie" Portable Radiophones

A new line of transistorized portable two-way radiophones, delivering up to 20 times the RF power output conventionally attained in such equipment, has been announced by Motorola. The complete line includes models with RF power output ratings from 1 to 8 watts. All units are housed in formed aluminum cases and the lightest and smallest model weighs only 7 lbs., 9 oz. complete. Optional accessories provide for operation in all services in these frequency ranges used in the public safety, industrial and transportation categories. For full details write Motorola, Technical Information Center, 4545 W. Augusta Blvd., Chicago, Ill., or circle **No. 3-26** on the reply card.



Scarifier attachment mounts on the Seaman-Andwall Pulvi-Mixer or Trav-L-Plant. Unit is hydraulically controlled by the operator. Check **No. 3-25** for details on this equipment. Use reply card.

• • •

Louisiana Water and Sewage Conference

The 19th annual Short Course for superintendents and operators of Water and Sewerage systems will be held in Pleasant Hall, Louisiana State University, Baton Rouge, La., March 14-16. George H. West, Box 15, Lake Charles, La., is secretary.

JOB OPPORTUNITIES

Sanitary Sales Engineer Available

Sales engineer with ten years experience in the sale of water and sewage works equipment is available. Contacts in past work have included municipalities, consulting engineers, industries and contractors. Satisfactory references for character and ability. Write Box 3A, Public Works Magazine, 200 So. Broad St., Ridgewood, N. J. All inquiries will be forwarded without acknowledgment.

Sanitary and Hydraulic Research Assistantships Available

The State College of Washington has several Research Assistantships available in Hydraulic and Sanitary Engineering, as well as Teaching Assistantships in Civil Engineering. These call for half-time service, and the degree of Master of Sciences in Hydraulic Engineering, Sanitary

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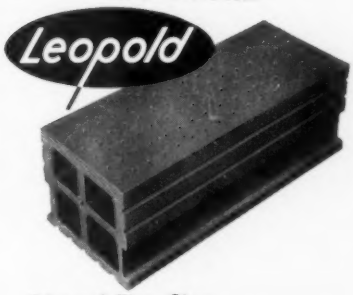

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INDEX OF ADVERTISEMENTS

Abrams Aerial Survey Corp. 186
Acker Drill Co., Inc. 173
Adams Co., Inc., R. P. 23
Air Survey Corp. 186
Alabama Pipe Co. 68
Albright & Friel, Inc. 186
Allis-Chalmers Co. 20, 21, 72, 73, 129
Alster & Associates, Inc. .....17 & 186
Alvord, Burdick & Howson 186
American Bitumulus & Asphalt Co. 161
American Cast Iron Pipe Co. 167
American Concrete Corp. 74
American-Marietta Co. 67
American Playground Device Co. 198
Ammann Photogrammetric Engineers, Inc. .. 199
Anthracite Equipment Corp. 182
Armco Drainage & Metal Products Inc. 45
ARPS Corporation 58
Asplundh Chipper Co. 18
Atlas Mineral Products Co. 164
Austin-Western Works
Baldwin-Lima-Hamilton Corp. .....158 & 159
Ayer-McCarel Clay Co., Inc. .....28 & 29

Badger Machine Co. 47
Baker, Jr., Michael 186
Bannister Engineering Co. 186
Barber-Greene Co. 39
Barker & Wheeler 186
Barstow & Associates, E. D. 186
Baughman Mfg. Company 130
Bell, Howard K. 186
B-I-F Industries 49
Black & Veatch 186
Blaw-Knox Company .....52 & 126
Bogert and Childs 186
Bowe, Albertson Assoc. 186
Bowerston Shale Co. .....28 & 29
Brown & Blauvet 186
Brown Engineering Co. 186
Browne & Associate, Floyd G. 186
Buchart Engineering Corp. 186
Buck, Sifert & Jost 186
Buffalo Meter Co. 147
Buffalo Springfield Roller Co. 113
Builders Providence 49
Burgess & Nipple 187
Burke, Inc., R. H. 187
Burns & McDonnell Engr. Co. 187
Burtchaell Heating Co. 152

Caird, James M. 187
Calgon, Inc. 51
Camp, Dresser & McKee 187
Cannelton Sewer Pipe Co. .....28 & 29
Capitol Engineering Corp. 187
Cast Iron Pipe Research Assoc. .....8 & 9
Caterpillar Tractor Co. 4, 86, 151
Chester Engineers 187
Chicago Pump Co. 3
Classified Ads 197
Cleveland Trencher Co. 127
Clow & Sons, James B. 19
Cole & Son, Chas. W. 187
Columbia-Geneva Steel Div. .....64 & 65
Computer-Measurements Corp. 44
Consoer, Townsend & Assoc. 187
Corrosion Control Inc. 187
Cotton, Pierce, Streander, Inc. 187

Darley & Co., W. S. 184
Deere, John 33
DeLeuw, Cather & Co. 187
Dempster Brothers, Inc. .....40 & 41
Dickey Clay Mfg. Co., W. S. .....28 & 29
Dotmar Industries, Inc. 76

Enterprise Engine & Machinery Co. 53
Essick Mfg. Co. 61

Fay, Spofford & Thorndike 187
Federal Sign & Signal Corp. 152
Finkbeiner, Pettis & Strout 187
Fisher Research Lab., Inc. 50
Fitchburg Engineering Corp. 157
Flexible Inc. 185
Flynn & Emrich Co. 62
Ford Meter Box Co. 144
Ford Motor Company
Tractor & Implement Div. .....54 & 55
Fridy, Gauker, Truscott & Fridy, Inc. 187

Galion Iron Works & Mfg. Co. 2
Gannett, Fleming, Cordroy &
Carpenter, Inc. 188
Gar Wood Industries, Inc. .....35 to 38
General Electric Company .....57, 70A to 70D
Outdoor Lighting Dept.
Gilbert Associates Inc. 188
Golden Anderson Valve Specialty Co. 166
Gorman Rupp Company 78
Graham Parking Engineers 187
Graver Water Conditioning Co. 181
Gray & Osborn 188
Greeley & Hanson 188
Green Co., Howard R. 188
Greenlee Tool Co. 75
Greer Engineering Associates 188

Hagan Corporation 51
Hamilton Kent Mfg. Co. 63
Hardie Mfg. Co. 182
Harley & Assoc., Frank E. 188
Harte Co., John J. 164
Hauck Mfg. Co. 17
Havens & Emerson 188
Hazen & Sawyer 188
Healy-Ruff Company 68
Heil Company 71
Henningson, Durham & Richardson, Inc. .. 188
Hercules Powder Co. 79
Highway Equipment Co., Inc. 156
Hill & Hill 188
Homestead Valve Mfg. Co. 177
Hunt Machine Co., Rodney 168
Hurd Aerial Surveys, Inc., Mark 188
Hydrauger Corp., Ltd. 50

Insto-Gas Corp. 14
International Harvester Co. 12, 13, 27, 143

Jackson Vibrators, Inc. 32
Jaeger Machine Co. 173
Johns-Manville 26
Jones, Henry & Williams 188

Kaiser Aluminum & Chemical Sales, Inc.... 137
Keasbey & Mattison Company .....148 &149
Kennedy, Clyde C. 188
Kerrigan Iron Works, Inc. 10
Knowles, Inc., Morris 188
Komline-Sanderson Engr. Corp. 83
Kwik-Mix Co. 48

Laclede-Christy Co. Div.
H. K. Porter Co., Inc. 6
Leopold, F. B. 154
Le Roi 171
Div. of Westinghouse Air Brake Co.
Le Tourneau-Westinghouse Co. .....178 & 179
Lewis, Harold M. 188
Link-Belt Co. 11
Littleford Bros., Inc. ..... 84 & 85
Lock-Joint Pipe Co. 59
Lozier & Co., Wm S. 188

M-B Corporation ..... 81 & 153
M & H Valve & Fittings Co. 142
Mall Tool Company 80
Massagglia Hotels 197
McWane Cast Iron Pipe Co. 176
Mebus, Inc., George B. 188
Merritt & Welker 188
Metcalf & Eddy 188
Minneapolis Moline Co. 69
Modern Swimming Pool Co., Inc., ... 183
Mueller Co. ..... 24 & 25

Natco Corp. ..... 28 & 29
National Clay Pipe Mfrs., Inc. 31
Neenah Foundry Company 136
Neptune Meter Company 43
Northern Gravel Co. 60

Onan & Sons, Inc., D. W. 76

Pacific Coast Borax Co. 131
Pacific Flush Tank Co. 175
Pacific States Cast Iron Pipe Co. 176
Palmer and Baker, Inc. 188
Palmer Filter Equipment Co. 44
Peerless Pump Division 169
Phelps Dodge Refining Corp. 172
Phelps, Inc., Boyd E. 188
Pirnie Engineers, Malcolm 188
Pitometer Company 188
Pittsburgh Des Moines Steel Co. 145
Pittsburgh Equitable Meter Div. 139
Pomona Terra-Cotta Co. ..... 28 & 29
Portland Cement Assn. 135
Preload Company, Inc. 46
Public Works .....48, 66 & 197

"Quick-way" Truck Shovel Co. 16

Ranney Method Water Supplies Inc. 82
Reed Mfg. Co. 183
Ridge Tool Company 81
Ripple & Howie, Inc. 189
Roberts & Co., Assoc. 189
Roberts Filter Mfg. Co. 194
Rockwell Manufacturing Co. 139
Russell & Axon 189

Seaman-Gunnison Corp. 133
Seay Co., Irby 189
Seelye Stevenson Value & Knecht 189
Servicised Products Corp. 34
Sherman Products, Inc. 155
Simplex Valve & Meter Company 30
Smith & Gillespie 189
Sparkler Mfg. Co. 56
Standard Dry Wall Products 70
Stanley Engineering Co. 189
Stilson Assoc., Alden E. 189

Taylor & Co., W. A. 194
Tennant Company, G. H. 154
Tennessee Coal & Iron Div. ..... 64 & 65
Tennessee Corp. 195
Texas Vitrified Pipe Co. ..... 28 & 29
Todd Shipyards Corp. 166
Trickling Filter Floor Institute ..... 28 & 29
Trojan Mfg. Co. 60
Tropical Paint Co. 160
Twin City Pigeon Eliminating Co. 189

Uhlmann & Associates 189
U. S. Concrete Pipe Company 77
Universal Sewer Pipe Corp.
U. S. Pipe & Foundry Co. 163
U. S. Steel Corporation ..... 64 & 65
U. S. Steel Export Co. ..... 64 & 65
U. S. Steel Supply Div. ..... 64 & 65

Wallace & Tiernan Co., Inc ..... Back Cover
Watkins, J. Stephen 189
Western Machinery Co. 165
Weston Co., L. A. 184
Whitman, Requardt & Assoc. 189
Williams & Assoc., Inc., Clyde E. 189
Wilson & Company 189
Wood Co., R. D. ..... 140 & 141
Worthington Corp. 13
Wright, Harry Otis, Jr. 189
Wyandotte Chemicals 26

Engineering, or in Civil Engineering normally may be obtained in two years. Remuneration is $1400 for the first academic year, and $1490 for the second. Summer work is generally available. For further information write to: Professor Emmett B. Moore, Chairman, Department of Civil Engineeering, State College of Washington, Pullman, Washington.

PERSONAL NOTES

JOHN R. SNELL AND ASSOCIATES is the name of the new firm of consulting engineers. Located at 6103 Lake Lansing Drive, Haslett, Michigan, the firm is headed by John R. Snell, formerly head of the Civil and Sanitary Engineering Depts. at Michigan State University.

CARLTON S. PROCTOR has been elected president of the American Institute of Consulting Engineers, succeeding FRANCIS S. FRIEL. Vice-Presidents are Richard Hazen and Robert W. Abbett.

KENNETH B. WOODS, Head of the School of Civil Engineering, Purdue University, has been elected Chairman of the Executive Committee of the Highway Research Board. The Highway Research Board, which operates under the auspices of the National Academy of Sciences and the National Research Council, is a cooperative organization of highway engineers and technicians.

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APWA Chapter News

(*Continued from page* 126)

ster Dumpster at Work" was also presented at this meeting. The 20 minute film illustrates a typical installation in a medium size city. Warren A. Barney, Secretary-Treasurer of the **San Diego-Imperial County Chapter** reports that their next meeting will be held at noon on Thursday, March 15, 1956 at the Mission Valley Country Club in San Diego, California. The theme of the meeting will be—"Do we Need Uniformity In Public Works Specifications and Contract Documents." David A. Mann, Director of Public Works of Niagara Falls, New York and President of the **Up-State New York Chapter** recently announced that the Annual Spring Meeting of that Chapter will be held in Niagara Falls on May 13-15, 1956.

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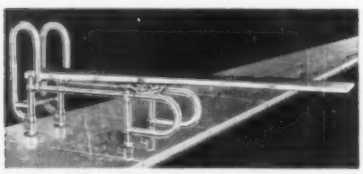

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WORTH TELLING

by Arthur K. Akers

★ ALLIS-CHALMERS MANUFACTURING CO. news includes election of Willis G. Scholl as executive vice president. He is succeeded as vice president of the Tractor Group by Boyd S. Oberlink. E. J. Mercer is appointed general manager, Construction Machinery Division.

Mr. Griffith

★ H. KEITH GRIFFITH has been named executive director of the new National Bituminous Concrete Association, with headquarters at 1145 Nineteenth St., N.W., Washington, D.C. Mr. Griffith was formerly commissioner of highways for the state of West Virginia and has been active in various highway associations for some years.

★ JOE H. SERKOWICH moves up again! He has just been elected a vice president of the Aubrey, Finlay, Marley & Hodgson Inc., advertising agency in Chicago. He is an account executive heading the group serving the Industrial Power Division of International Harvester Co.

★ W. B. (BART) MARSHALL has been advanced to the new position of manager, market development and sales training at Chain Belt Co., Milwaukee; G. H. Pfeifer is promoted to the new position of manager, sales promotion and advertising.

Mr. Marshall

Mr. Pfeifer

★ LINK-BELT CO. names Donald L. Shirley Pacific Northwest sales manager, Seattle.

★ THE ASPHALT INSTITUTE, College Park, Md., promotes Robert B. McKeagney from New England district engineer to deputy division engineer for the Atlantic-Gulf Coast Division at New York. John F. Pearring succeeds the late John Banning as their Denver district engineer.

★ AMERICAN CAST IRON PIPE CO. promotions include: Arnold J. Herrmann to executive vice president. J. W. MacKay succeeds him as vice president, sales manager, and secretary, at Birmingham. James B. Hill becomes assistant sales manager; and Paul W. Green will now manage the Kansas City Office.

Mr. Herrmann

Mr. Fauntleroy

★ PITTSBURGH - DES MOINES STEEL CO. Pittsburgh, announces the retirement of John E. O'Leary, long general sales manager and widely known in this field. T. W. Fauntleroy, his former assistant, succeeds him.

★ JOHN E. DUESING is now sales manager, mechanical division of Hagan Corp., Pittsburgh.

★WALTER K. NEUBAUER becomes an associate member of the firm of O'Brien & Gere, consulting engineers, Syracuse, N.Y.

★ M-B CORPORATION, New Holstein, Wis., manufacturers of refuse packer bodies and other municipal and highway equipment, names Don Farmer western regional sales manager.

★ HUSBAND to friend: " My wife is two hours late. She's either had a car accident, been kidnapped, or she's shopping. Man, I hope she ain't shopping!"

—Deco Trefoil

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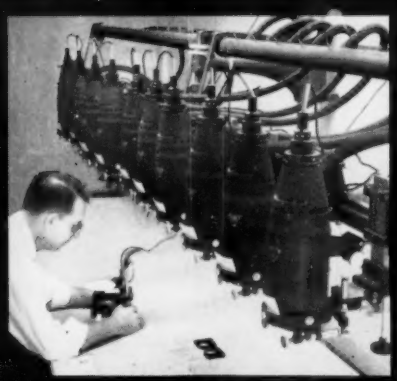

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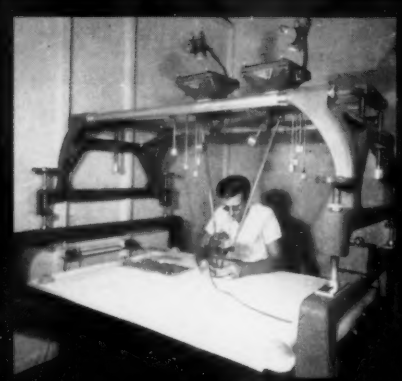

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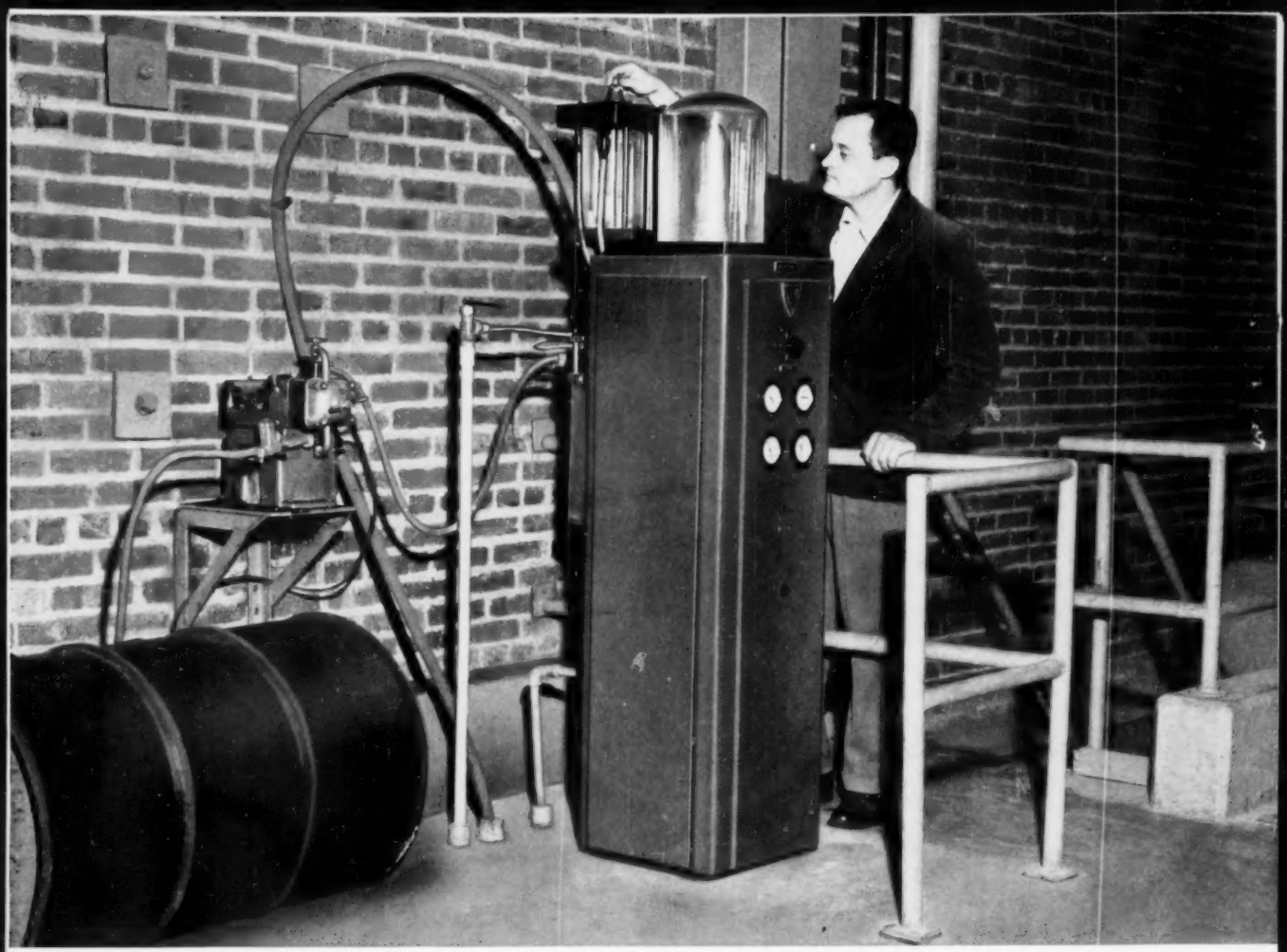

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